

JUNE, 1933

Plastic Products

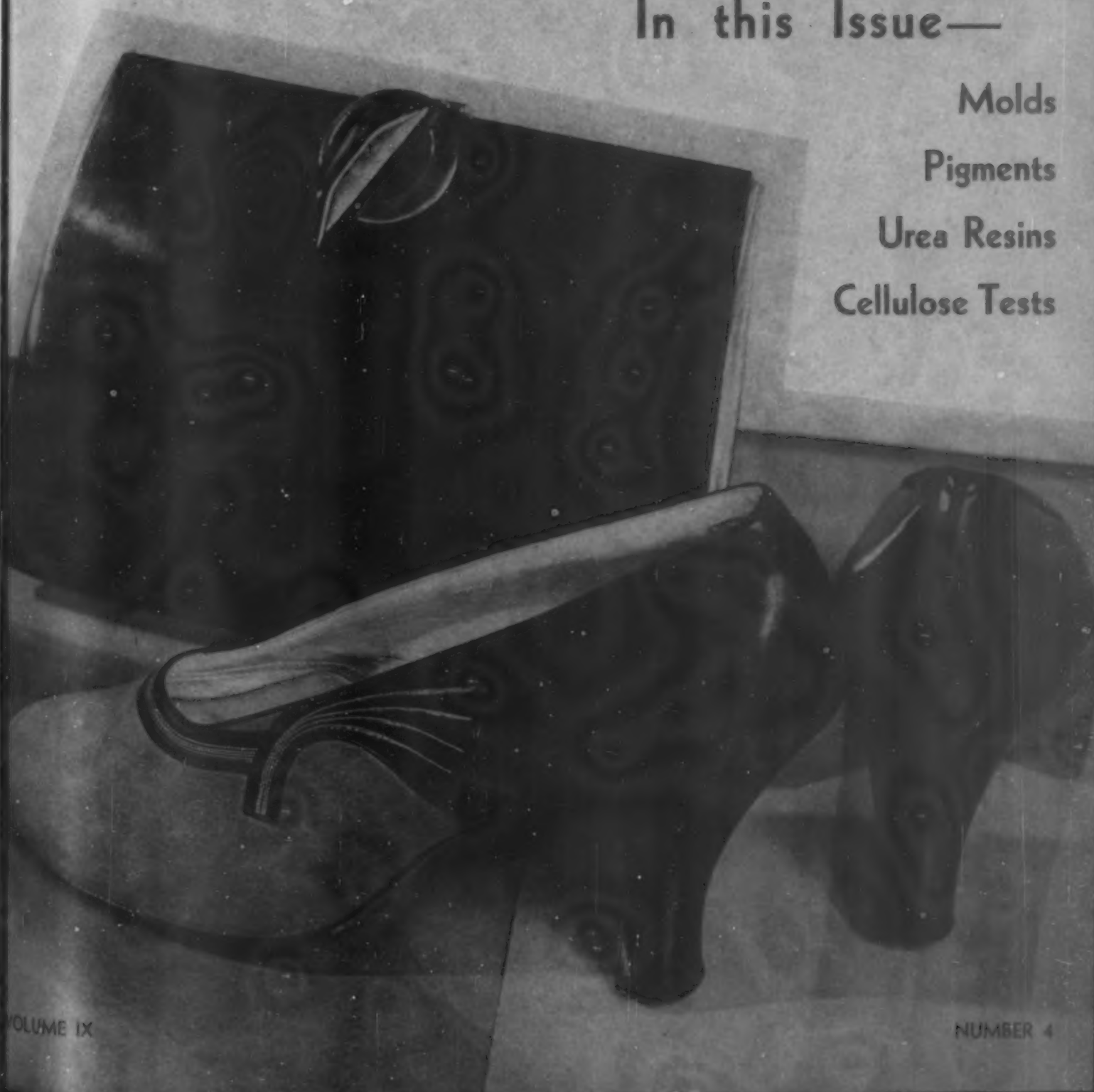
In this Issue—

Molds

Pigments

Urea Resins

Cellulose Tests



DUREZ PRIMER

Pertinent facts about a prominent factor in the plastics industry . . . General Plastics, Inc. . . . for the consideration of manufacturers with an eye open to Big Business.

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DUREZ

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PLYWOOD AND VENEER RESINS

OTHER DUREZ PRODUCTS

● **Laminating Varnishes:** Phenolic varnishes for producing laminated sheet, tube and rod stock—in various odorless, high dielectric, decorative, punch stock, water-resistant grades. Finished stock is widely used for insulating, structural and architectural applications.

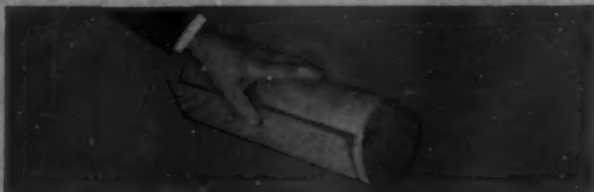
● **Insulating Varnishes:** High dielectric baking-varnishes for insulating work, of phenolic origin and thermosetting in nature. Used in impregnating coils and other electrical parts, for better insulation and moisture resistance.

● **Treated Paper:** Laminating paper of various types, factory-impregnated with Durez Laminating Varnishes, shipped in rolls and ready for the laminating press. Filler and liner sheets, impregnated to order.

● **Molding Compounds:** Phenol-formaldehyde molding powders of the thermosetting type, formed in heated steel dies, available in black and all colors. Used for electrical parts, knobs, handles, novelties, bottle caps, jars, boxes.

● **Oil Soluble Resins:** 100% phenolic resins, odorless, soluble in common drying oils, ready for incorporation in paint and varnish formulations, giving greater durability, quick-dry and better flowing qualities to the finished product.

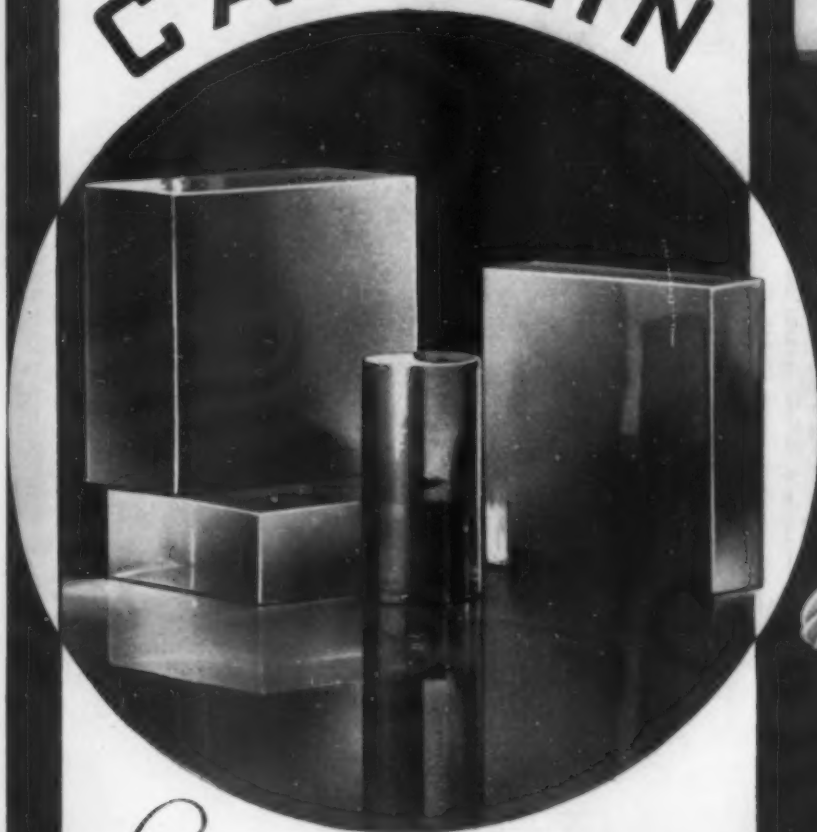
● **Colloidal Resins for Cores:** A resin-binder for sand cores in foundry work, especially for the better type of aluminum and brass casting. Reduces porosity of the metal, and being thermosetting gives excellent definition and reduces core gases.



"In both wet and dry tests these new resin-bonded veneers show three to four times the strength of plywood bonded with ordinary glues."

*Render unto Beauty
the Things that are Beautiful*

CATALIN



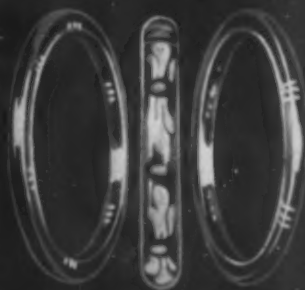
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in Jewelry*

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Plastic Products

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and the Engineering Index Service*

Volume IX

Number 4

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Plastic Products

VOLUME IX



NUMBER 4

Hang Together or Hang Separately

PLASTICS' best interests can no longer be served by affiliation with established trade associations of older industries. This fact is made plain by the agitation roused by the Industries' Control Bill. Very real need for efficient group representation lays bare the dangers of allowing rivals or customers to speak officially for the plastics industries.

Lacquer is a competitor of paint and varnish, and the quick, cordial support won for the new proposed Lacquer Institute shows how incompatible the old alliance with the Paint and Varnish Association has become. The molders are bestirring themselves to declare independence of the electrical association with which they have been affiliated.

Whatever expediency once justified that alliance holds no longer. Until that happy day when the lion and the lamb shall lie down together, no logic justifies the maker of artificial leather in expecting tanners to represent his interests nor can tempt the maker of plastic impregnated textiles to cast his

lot with oilcloth and linoleum.

All our plastic products are new competitors of these old industries. The future belongs to us. We are leaders in the Chemical Revolution, as potent an economic event as the Industrial Revolution a century ago. We have a common chemical origin; we use the same raw materials; however different our processes and our products we are all in direct competition with older, natural materials, and our common end is to furnish modern industry with synthetic substitutes, highly specialized for particular uses, better and cheaper and infinitely more adaptable than our natural rivals.

Here is the common ground. Now is the time to make a united stand. A Plastics Institute, embracing all plastic products, would command the support of the powerful chemical interests who supply our raw materials and demand the respect of competitors and customers. Sound logic backs this plastics alliance. In such a union there is great strength.

A Personal Message

to



the

Lacquer Manufacturers

I HAVE undertaken the job of organizing the lacquer industry. I have done this because I think it is something that badly needs to be done and because I feel I can do it as effectively as anyone else. In the past I have been opposed to all forms of artificial restraint which would interfere with individual initiative and the open market. I have not changed my mind. I recognize, however, that conditions are so bad as to make a compromise, during the emergency, necessary. Further, it seems evident to me that the President is going to put through Congress the "National Industrial Recovery Act." If this act is passed, you will be immediately faced with the necessity of regulating yourselves or having regulation forced on you by outsiders.

Organizing an industry like the lacquer industry in a way which will be effective and yet not burdensome on the individual units making up the industry is no easy job. It cannot be done by mass meetings and committees. Someone must accept responsibility for pushing it and must be prepared to give it his undivided attention. That man must know the industry and be known in the industry, but he ought to be as free as possible from any direct connection with individual concerns in the industry. He ought to have a record of accomplishment as an organizer. Those who asked me to start this work believe I qualify. That is why I am willing to undertake the job.

Is a separate lacquer association needed? A number of lacquer manufacturers belong to the National Paint & Varnish Manufacturers Association. Can regulation of lacquer under the proposed "National Industrial Recovery Act" be handled by this Association along with paint and varnish products? It goes without saying that a lacquer association should cooperate in every possible way with the National Paint & Varnish Manufacturers Association. But the lacquer industry is complex enough by itself. Many of the men I have talked to are skeptical of the effectiveness of a lacquer association because of the variety of lacquer products and the wide divergence in the kinds of service the different manufacturers render. In spite of these difficulties I am personally confident that a great deal can be done. It cannot all be done at once. Whatever organization tackles it, it must be for lacquer first, last and all the time. It cannot be looking out for paint and varnish at the same time.

By Frank G. Breyer

Does this mean that a company making paint, varnish and lacquer will have to belong to three different associations? I am inclined to think it does. If we must have regulated industry, we certainly want the best regulation we

can get. We want clean-cut organizations under responsible managers who can be removed if they do not produce results, but who will be free to act promptly and decisively so long as they are in control.

This view is supported by the fact that the proposed National Industrial Recovery Act provides that an association that wishes to operate under the Act must (1) *truly* represent the trade or industry for which it speaks; (2) admit freely to membership all who are engaged in the same trade or industry; and (3) not oppress or discriminate against small business enterprises.

Many lacquer manufacturers do not belong to the National Paint & Varnish Manufacturers Association. In the New York Metropolitan area, for instance, there are about fifty lacquer manufacturers, of which eleven belong to the National Association. This is not necessarily a serious obstacle because these companies could easily join up if they wanted to. However, the question immediately arises as to the division of costs among the activities for the different products. All of this seems to me to introduce complications and opportunities for argument and misunderstanding which are quite unnecessary and certainly undesirable.

Now as to the form of organization which would be most effective for the lacquer industry, I am giving this matter careful study at the present time. It is a subject on which we need the assistance of the best lawyers we can get. In principal, however, I am convinced that the only form of association which will function effectively is one in which real power is delegated to a manager and he accepts corresponding responsibility for the effectiveness of the control. It should not be necessary to hold frequent meetings. Questions which are bound to arise as to whether members are living up to the rules will be investigated by the manager and definite decisions and action taken. In other words, a dictatorship. Provision must be made to remove the dictator if he does not produce results but he should be as free as possible to carry on for the benefit of the whole industry so long as he is in the saddle.

A great experiment in government co-operation with business is about to be undertaken. It is something new to all of us. I have tried to tell you as frankly as possible how I think it may be used to the good of the lacquer industry.

I need the benefit of suggestions from all of you so that I may be able to present a definite proposition in the shortest possible time. I also need to know as promptly as possible how many of you approve the action I am taking. You can show this by joining the temporary organization which is described in the accompanying article.

Move to Organize the Plastics Industries

Frank G. Breyer Working with
the Lacquer & Molders' Groups

On May 17 a group of 19 lacquer manufacturers met at the Hotel Lombardy in New York City and formed a preliminary organization and agreed to contribute to an organization fund. This meeting was the result of an earlier informal gathering of ten or twelve local manufacturers on May 12, who were called together by Frank G. Breyer of Singmaster & Breyer, the result of a visit of Mr. King of the Van Schaack Chemical Works, Inc., and his suggestion that many of the lacquer manufacturers were in favor of Mr. Breyer's heading such a movement. At the preliminary meeting, May 12, sentiment was strong for the formation of a representative group.

Moving swiftly but cautiously invitations were sent out to all manufacturers in the Metropolitan area to attend the May 17 meeting. Invitations were not extended to the five largest producers—Devoe & Raynolds, Du Pont, Glidden, Pittsburg Plate Glass, and Sherwin-Williams—but they were notified that such a meeting was to be held and explanations given of the purpose. It was felt that a more effective organization could be obtained if the first steps were taken by the small and moderately-sized companies and then the large companies invited to join. In this way it was felt that the smaller manufacturers would feel that their interests would be properly represented in the organization.

After some discussion the following resolution was adopted:

Whereas it is the belief of the lacquer manufacturers present at this meeting that organization of the lacquer industry is necessary, and

Whereas funds are required to proceed with this organization,

BE IT RESOLVED that a preliminary organization is hereby formed to bring about stability in the industry and to repress or remove conditions which are causing losses to management, depreciation of wage rates and a further aggravation of the unemployed situation. Any manufacturer of lacquer shall be eligible for membership. Members shall pay \$50 if their sales for the calendar year 1932 were less than \$100,000, and \$100 if such sales were more than \$100,000.

At the close of the meeting on May 17, thirteen companies immediately signified their intention of joining. Before June first, seven additional companies joined the group.

In the meantime the Molded Insulation Section of NEMA at a well attended meeting May 19, presided over by Chairman Douglas Woodruff of Auburn Button Works, in view of the recent developments in Washington on the Industrial Control Bill, very seriously discussed the advisability of forming an independent organization distinct from the present NEMA connection. It was felt by a large number of those present that such action would give the molding industry greater standing and greater freedom of action.

The suggestion has been made that it might prove desirable to join with the proposed lacquer manufacturers group to form the nucleus of a Plastics Group that would be truly representative of the entire plastic field. An informal committee consisting of

Those who join will risk little, since they make no commitment as to the final organization. They will do much for themselves and the industry by insuring prompt action at a time when delay may be very costly.

The situation has its uncertainties and dangers as well as its possibilities for betterment. You may soon be buying from organized groups, selling to organized customers and hiring organized labor. Don't you see that you must have an impartial, effective organization to aggressively represent your interests if you are to live and prosper under such conditions?

George K. Scribner of Boonton Molding, Williams Haynes publisher of PLASTIC PRODUCTS, and Frank G. Breyer has met to consider ways and means of providing the outline of an organization, providing it appears that sentiment favors such action.

The so-called "New Deal" opens up an entirely new phase in the history of our national development industrially. Senator Wagner in discussing the "National Industrial Recovery Act" says, "The bill authorizes any group or association within a trade or industry to prepare a code of fair competition which sets forth the standards covering trade and competitive practices within that industry. Such a code is without effect until it is approved by the President.

"The President may approve such a code if he finds: 1. That the group presenting the code truly represents the trade or industry for which it speaks. 2. That it admits freely to membership all who are engaged in the same trade or industry. 3. That the code of rules is fair to competitors, employees, and consumers. 4. That it will not promote monopoly. 5. That it does not oppress or discriminate against small business enterprises."

Every responsible executive in the plastics industries knows but too well the thoroughly demoralized state of the business and appreciates that there is a prospect of relief in the organization of a strong trade association such as is contemplated in federal legislation. In fact, this legislation is specifically designed for this purpose, and it would be suicidal not to grasp this great opportunity. The more so, since hundreds of such trade associations are being formed, and unless concerted action is promptly taken, the industry may find itself not only buying from well organized groups, employing organized labor, and selling to organized customers, but eventually forced itself to submit to Government regulation, for as Richard Washburn Child has pointed out what this law says to you is simply this: "Go and organize your industry yourselves. If you do well, blessings upon you and here's your licenses. But if you mess it up, or quarrel with labor, or do not swallow the minimum wages or hours of labor we tell you to put in effect, your appeal is to heaven only. And if you have any trouble with your individual members, just speak to us and they will have to play ball, or see what they shall see."

We are face to face with a great opportunity that is at once a dangerous threat.

The following 20 companies have already joined in this movement to form an organization of lacquer manufacturers: Atlantic Chemical Co., Atlantic Lacquer Manufacturing Co., Beckwith-Chandler Co., Brevolite Lacquer Co., Duralac Chemical Co., Egyptian Lacquer Co., Impervious Varnish Co., Mayer & Loewenstein, Nitrosol Co., Monroe Sander Corp., Roxylol Flexible Lacquer Co., Standard Varnish Works, H. V. Walker Co., C. A. Willey Co., A. C. Horn Co., John L. Armitage Co., Essex Chemical Co., John W. Masury & Son, Lacquer & Chemical Corp., Valentine & Co.

Pigments for Plastics

By Robert W. Boise

Technical Director, Paul Uhlich & Co., Inc.

Two years intensive work with dry colors in various plastics are summarized here with the conclusion that properly formulated certain pigments produce better results at less cost than can be obtained from other types of coloring materials.

IN CONSIDERING dry colors there is a very marked division between the two important classes of color which have a very decided bearing on their efficiency, and in fact on the possibility of using them at all in moldings or coatings.

We have reference, of course, to the so-called inorganic class of pigments which includes earth colors like siennas, umbers, red oxides, etc., cadmium colors, chromium colors, like chromium oxides of green, and others of similar nature. The second classification is generally and in the larger sense known as the synthetic or organic lake colors. These are the colors with which we are here most concerned, although of late the nitrocellulose branch of the plastics industry has been consuming increasing quantities of various cadmium colors, that is the sulfides and selenides.

The general application of any set of given rules for the use of the synthetic or organic lake pigments in plastics is impossible because there are so many factors that have a direct bearing on whether or not these colors can be used in molding compounds without definite and destructive structural change. In a broad sense most colors for plastics must be reasonably resistant to heat for short periods of time. This is only part of the consideration, however, since the use of many of the curing agencies such as hexamethylenetetramine have a decidedly adverse effect on some otherwise suitable colors.

No one expects that pigments will ever supplant dyes in more than a few cases although it cannot be denied that the use of these pigments has grown slowly but steadily. This is not surprising when it is known that more and more dependence is being placed on lake pigments as contrasted with dyes as a means of protecting the admittedly unstable discoloring properties of most resins. One of the greatest factors in recommending the use of lake pigments has been the lack of knowledge or rather the lack of application of the knowledge gained through experience in supplying these colors to the plastic industry. Perhaps in no other branch of industry with the possible exception of rubber compounders has the old axiom "What is one man's meat is another man's poison" been so true. Frequently the experience with a certain color in a certain type of resin has been applied to the same resin in different processing, and the result perfectly satisfactory in the first instance has proven a disastrous failure in the second. Therefore while we have established in theory only four general principles involved in the possible preference for dry lake colors these are not by any means universally applicable. However, in general the theory underlying the possible preference for dry lake colors over dyestuffs might be summed up as fourfold.

1. Their complete homogeneity when incorporated into the molding powder and the absolute assurance that no further solubility can take place.

2. Granting the known factor of color change in most synthetic resins, pigments are more apt to act as a protective as well as a coloring medium than are dyestuffs.

3. Dry colors even the most fugitive variety are more stable under violet rays than many of the dyestuffs from which the dry colors are made.

4. The complete dispersion of the pigment throughout the molded article gives a cleaner, more regular and less mottled surface than is likely to result with dyestuffs.

The factor of cost has yet to be definitely and accurately established but in several instances actual lowering of the cost of production has resulted through the use of dry colors.

In trying to outline the outstanding requirements for a dry color for the plastic industry, we should say that there are three fundamentals to be observed.

1. Reasonable fastness to light.
2. Reasonable stability under molding temperatures of 300 Fahrenheit or thereabouts for not less than three minutes.
3. Finest possible pulverization to render the easiest possible dispersion in the compound.

Black Lacquer Finish

For dull black or glossy effects lacquer affords an excellent medium, but much depends on the preparation of the surface before application of the lacquer coat. When dealing with brass articles it is essential that the metal should first be cleaned, then oxidized by a process which will turn the surface black. A successful method is as follows: First sand-blast the brass article, then put it on a hot plate, and when the article is warm apply a saturated solution of nitrate of copper and water. A saturated solution of nitrate of silver and water should be available. Taking two parts of copper solution and one part of silver solution, dilute with two times its volume of water and apply to the brass. Then burn the article on the hot plate. When applied the solution will be green, turning to brown, and finally to black. When it becomes black, remove the article from the hot plate and brush. It will be found that the brass has a metallic black surface which has been burned into it. When cool hang in a sulfurette of potassium solution for about five minutes. The article should then be dried and is quite ready for the black lacquer.

MOLDS

Construction and Costs

By Edward F. Bachner
Gen'l Mgr., Chicago Molded Products Co.

IN DESIGNING a mold for plastic materials, not only the cost of the mold itself, but the cost of piece production also must be considered. A well designed mold will save time in both the molding and finishing operations, while a poorly designed and constructed mold slows up production with consequent higher piece-part costs.

An important consideration also is the kind of molding material that is to be used. Different materials have different bulk factors. This means that a mold built for standard wood flour material, which has a bulk factor of 2 to 1, will not have well space enough for canvas material, which has a bulk factor of 8 to 1. By well space is meant the chamber into which the molding material is loaded. Different materials vary as to shrinkage, and this factor has to be taken into consideration.

The first step, after an analysis of the part has been made and the general type of mold decided upon, is the making of drawings for the mold. When these have been made and checked in the Engineering Department, orders should be placed for the various steels and forgings that are required, for if special forgings are required, it may take four or five days before the actual work can be started. Various kinds of steel are used depending upon the size, shape and service to which the mold is to be put. All steel surfaces which form the molded piece must be hardened, ground and polished, for the finish in the mold determines the finish of the molded part.

Machine steel or low carbon steel is pack hardened usually to a depth of about 1-16", which is satisfactory in most cases. High carbon tool steel and alloy steel harden clear through. The advantage of these steels is that they will not shrink or distort in heat treating, as will a low carbon steel. Heat treating and

hardening of molds is one of the most important factors in making a mold, and low carbon steel is generally used for the following reasons:

1. It will forge and machine much easier than high carbon and alloy steel.
2. The cost is less than half that of tool steel.
3. The low carbon steel mold will not crack if excess pressure happens to be applied.

In forging various shapes and sizes of steel for molds, many internal stresses are set up in the steel, due to hammering and uneven chilling. For this reason, steel parts should be reheated and left to cool very slowly. This tends to normalize the different strains that have developed. It is good practice to normalize mold parts again after they have been machined close to the finished dimensions. The mold sections should then be finished to their correct dimensions.

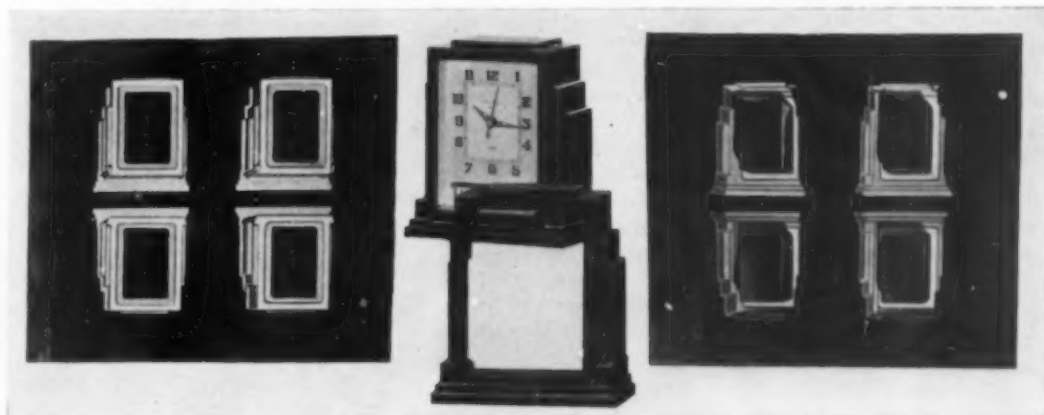
After that, they can be subjected to carbonizing and hardening treatment. This is accomplished by packing the molds with compound in a sealed iron box. They should then be heated to approximately 1,600 degrees F. and kept at that temperature for several hours, depending upon the depth of case hardening desired, and then taken out of the oven and left to cool in the pots, to avoid setting up any internal stresses in the steel. They should be again reheated to about 1,450 degrees and quenched in oil. The last stage is tempering the hard steel, so it will not be too brittle, this is accomplished by placing the molds in hot oil usually at a temperature of approximately 500 degrees. Throughout this process, great care must be taken not to mar or scale the surface of the mold. Too high heat or exposure to cold air will scale the steel.

The tedious job of polishing the hardened mold depends to some extent upon the condition of the mold after hardening. Emery and oil on wood or felt pads are used for polishing. Any shrinkage, distortion or deep scaling must be corrected. This must be done by grinding. It may be machine grinding or hand grinding with flexible shaft equipment, such as used by dentists in grinding teeth.

Machine steel is always used when cavities are to be hobbled. Hobbing is sinking a master force, or hob, of the exact shape and size, of the piece to be molded into a block of steel. Irregular shapes like knobs, handles, name-plates and other similar parts, if not too large, are hobbled by die sinkers who highly specialize in this work.

Molds for molding phenolic resins have to withstand pressure of 3,000 lbs. per square inch and about 350 degrees of temperature. They differ, therefore, radically from molds used for other materials, such as shellac, celluloid, etc. and have different working parts. These are the bottom plate, yoke, plunger, etc.

Molds are classified as either hand molds or semi-automatic hand molds, and as their name indicates, are those which are handled manually. An operator usually handles two or more hand molds. They are preferred when the part quantities are not great or when the parts are small so that a large number of cavities can be built in a small space. Again, if there are many inserts to be located in a mold, the hand mold has its advantage,



Center, clock case
molded on the molds
shown on either side.



Center illustration is mold producing the small gear shift knob shown to lower right, which are made in sets as shown on either side. The flash is broken away afterward.

as it can be loaded on the work bench while the alternate mold is in the press. Another instance when a hand mold is better is when it has a number of loose sections or split cavities, as in the molding of studs or coil bobbins, or when a piece has molded threads, which must be unscrewed before the part can be removed from the mold. Hand molds are heated between two steam heated platens and dismantled under arbor presses. They may be transferred to cold presses for chilling.

Semi-automatic molds are mounted permanently in the press while in operation. They are, as a rule quite heavy. However, weight is no objection in this kind of a mold, and the more cavities in the mold, the cheaper the pieces will be, but of course, the mold price increases. Molded parts from such molds are ejected automatically on the opening stroke of the press. These molds are drilled for steam channels which carry heat constantly through the mold, as close to the molded part as possible, thereby maintaining an even heat.

Unless a person understands tool making and has some idea of the time and labor required to engineer, design, and make even a simple mold, he may be appalled by mold costs. For this reason it is well to acquaint a prospect with some of the various operations and attendant costs that enter into the making of a mold. Explain that the first thing to consider is the number of cavities in the mold. This will be determined by its size and the quantity, or daily production of parts required. As a rule, estimate what one cavity will cost and multiply that by the number of cavities in the complete mold, discounting some according to the number of cavities.

Let him understand that the mold for a piece that is round or circular, can be machined and polished easier, and will cost less

than a mold which because of the shape of the piece requires intricate milling operations followed by skilled hand filing and polishing. Parts that have irregular shape openings in them cost more than those with round holes. Molds that have loose sections cost more than the more simple molds, and so do the molded pieces.

When a good finish is required, for example, clock cases, display boxes, novelties, etc., additional labor must be added, by way of polishing operations both on the mold and on the part, and this runs costs up. Tolerances in a given piece must be given serious consideration. Close tolerance adds to the cost of molds. Tolerances of .002" should not be called for if tolerances of .005" will do just as well. Remember, it is not only in the mold, but in the raw material that the shrinkage may vary.

Engraving, if any is required, is another additional cost. Sometimes engraving is located in a very difficult place to reach. The cost of engraving varies on the character of letters,—whether special or standard sizes and shapes. Raised letters on a molded piece, mean sunken letters in the mold, which are easier to engrave than raised letters in the mold and which reproduce sunken letters in the molded part. These should be used only when the lettering is to be filled in with color.

Amortizing the cost of a mold for a customer over a certain number of parts is generally a dangerous practice for the molder. Let the prospect understand that the mold cost must be paid by him and that the molder should not be asked to carry this investment for him. Prospects will not be so shocked by mold costs, if they know how these costs are figured, and requests for amortizing mold costs will be made less frequently by them.

Plastics

The word plastic means a material which takes shape or form and retains that form for a period of time. The technical plastics covered by what is now known as the plastics industry might be described as materials which take shape or form by application of heat with or without pressure and retain that shape on cooling. Bituminous plastics are made from natural asphaltic material, enormous deposits of which are to be found in the Rocky Mountain district. This bitumen material is chiefly suitable for use as a basis for plastics of the non-heat hardening type and when incorporated with fillers such as asbestos, etc., forms the basis of insulating molding used in the electrical industry.

Shellac, which is obtained in thin flakes by pouring the refined molten lac on rotating drums or by stretching by hand, enters largely into the manufacture of the rigid gramophone record of which industry has used as much as 20,000 tons annually.

Celluloid, made by treatment of cotton with a mixture of nitric and sulfuric acid, was first commercially produced in 1869; today, the world production varies from 30,000 to 40,000 tons per annum.

Dealing with synthetic resin plastics, the first of these to be commercially developed was Bakelite. This class of plastic is

dependent on phenol and formaldehyde. These materials react together to give a hard transparent amber-like body which is inert in many solvents, chemicals and conditions and finally is a relatively good insulator. Another member of this class is amino resin, in which urea or thiourea is used instead of phenol; this produces a water-white or opaque product. These synthetic resinoid plastics readily flux under heat and pressure and are introduced into a steel mould in which the design of the final article is cut or engraved on the opposite or negative form; when subjected to heat and pressure the material rapidly fuses and takes the shape of the containing mold, chemically hardens, and can be ejected from the mold in the solid finished form. This chemical process is sometimes known as "freezing by heat." Glyptal, prepared from glycerin and phthalic acid is not used extensively in the molding industry on account of the long period for which it has to be heat hardened. It is, however, used in the paint and varnish industry in the manufacture of quick-drying enamels and paints.

Although comparatively new, the plastics industry may play a very important part in the industries of the country, and the artist, the architect, and the engineer has available for his use a new material of great possibilities.

COATINGS

Historical Outline Concluded

By Bradford S. Covell

THE World War was the immediate cause of intense activity and marked advancement in the lacquer industry. During the war clear lacquer solutions were in great demand as a water-proof coating for aeroplanes. Much was learned then about solvents, thinners, and spray application. The cessation of hostilities found the munition factories with huge stocks of cellulose nitrate on hand. Of huge military value, these stocks were of very limited use for peacetime purposes, and the most logical action would be to convert these stocks of gun-cotton into lacquer. But in order to absorb the tremendous stocks of material on hand something more interesting from a coating point of view was required than the clear lacquer dopes which had been in use for 60 years. Meanwhile the enamel and varnish manufacturers had intensified public interest in "4 hour drying" and a coating which would withstand boiling water poured from a kettle, which was so extensively pictured in advertisements. From a lacquer point of view, quick drying and moisture resistance were properties which were virtually made to order, and so the field was well prepared for fast drying and resistant coatings. Intensive laboratory research work was required before the secret of the ready manufacture of low-viscosity nitro-cellulose lacquers was discovered. Several different companies apparently had a hand in this development from which may be traced the tremendous growth of pigmented lacquers. A popular story (for which the writer assumes no responsibility) having to do with this development is as follows: "After many weary days vainly spent in attempting to secure a thin watery solution containing a high percentage of nitro-cellulose, a certain chemist left his flask over the week-end near a steam radiator. On Monday morning, what he had last seen as a thick gluey solution was transformed into a thin watery solution which would take a considerable amount of additional solids (pigments) and still remain thin enough to spread easily by spray application." This happening of course did not solve the problem, but it may have pointed the way in showing the effect of a long, warm digestion. Such a digestion, incidentally, has a similar effect on the viscosity of certain synthetic resin solutions, which in hot weather may be transformed in shipment from a highly viscous solution to a watery one apparently lacking in solid content. In any event, it is this development of low viscosity lacquer solutions with comparatively high solid content that marked the start of our present lacquer industry, with its many applications, as we know it today. Numerous patents were granted on this low viscosity feature and, as is usual in the field of plastics (with one notable exception in the alkyd resins) litigation in the courts followed close behind. For industrial spray and dip application the new lacquers were in great demand. Probably nine-tenths of our automobiles obtain their color coat with nitro-cellulose in some form or other. Because of its quick set, and more important,

because of its comparative ease in color matching compared with synthetics, nitro-cellulose lacquers are indispensable in patching automobile finishes which become marred during the assembly. The patch coat penetrates easily and gives a covering which is almost impossible to detect. Ordinary pigmented lacquers dried much too fast to be applicable by hand brushing. The film would set too fast to permit the elimination of brush marks. Later, by combining the cotton with various synthetic resins and plasticizers, excellent brushing lacquers were developed.

This great expansion in the use of pigmented lacquers was not entirely due to the development of low-viscosity cotton. The solvents manufacturers responded nobly to the increased demands of lacquer—not only in quantity of solvents available, for there were also huge stocks of straight lacquer solvents available at the close of the war—but also in quality and types of thinners developed in commercial quantities. Lacquer solvents and thinners, not a trace of which remain in the dried film, have played a much more important part in the development and establishment of lacquers than is generally realized. Lacquer solvent mixtures are a study in themselves and have a great deal to do with the economical application, and the gloss, smoothness and general appearance and durability of the coating they leave behind when they evaporate.

Extensive research is continually being undertaken by the solvents manufacturers to further improve their solvents and thinners. Incidentally, these two terms, with apparently a very similar meaning, are not the same at all when used in a lacquer mixture. The solvents do the original cutting of the nitro-cellulose; the thinners may be added to do what their name implies and also to actually thicken the mixture, in terms of viscosity, while at the same time lowering the solid content. The economical use of lacquer is very much dependent on the handling of the thinners. In short the proper handling of the solvents and thinners is as important as the cotton itself in the compounding and application of pigmented lacquers.

About this time (1920) synthetic resins began another development. New resinous mixtures, with properties somewhat similar to China wood oil-gum combinations began to make their commercial appearance. Better weathering and faster drying properties were in demand. Nitro-cellulose lacquers led the field in rapid drying, but in the early mixtures were lacking in adhesion and flexibility. The important class known as alkyd resins received much attention during this period. These resins are made by combining a poly-hydric alcohol, such as glycerine, with a poly-basic acid such as phthalic acid. This reaction was first studied extensively by Watson Smith in 1901, but little had been done to commercialize the product. Such a combination forms an ester and these reaction products are on the same order of formation chemically as ester gum. By adding various other

modifying agents such as vegetable fatty acids to the initial reaction the final products may be varied to form a long series of interesting coating materials, some of which are reactive with drying oils. To obtain the best and most durable results with these alkyd resin solutions various metallic driers are necessary.

These materials furnish satisfactory grinding media for pigments and have been developed so that a considerable amount of color may be incorporated. Three types of the alkyd class of resins have been developed and these are described as being heat-reactive, non-heat-reactive, and element reactive. Each class has its special use and will be taken up in detail later. The most marked characteristic and striking property of these resins is flexibility and it is probably this property which, more than any other, has caused such concentration of chemical talent in their development. Three large companies, having pooled their patent assets, have more or less co-operated in the development of these resins. This policy of co-operative patent pooling, without litigation, has probably resulted in greater advancement for all concerned, than would have resulted from years of court action among the holders of basic patents. These alkyd resins are being developed with two different objects in view—their use as cast solids, and their application in solution for use as coatings. Because of their flexibility and compatibility with nitrocellulose the alkyd resins have been of great value to the compounders of pigmented lacquers in securing better adhesion and more flexibility. The lack of these essential properties in lacquers had long been a weak point in the full development of cellulose ester coatings. The wide use of the alkyd resins in either the cast or molded form has been hindered because of the slow setting or cure of these solid resin masses. This property of faster set is receiving considerable attention and much is expected of future developments along this line. In the field of coatings, solutions of alkyd resins are fast making a field for themselves. It is interesting to note that house paints, which in their essentials have remained unchanged for years, are beginning to yield to the influence of these new resins. House paints probably constitute the most conservative of all classes of coatings in making fundamental changes. This is understandable when it is realized how many millions of small users there are who are accustomed to house paints such as linseed oil-pigment-turpentine mixtures and who are immediately suspicious of any new odor or other small item of change in their can of paint. Even the apparently small detail of a different brush cleaning solvent has proven to be an obstacle to the more rapid acceptance of alkyd resin solutions in house paints. From this it may be realized the tremendous amount of patience and perseverance necessary before anything new in the field of coatings is whole-heartedly accepted by a majority of users. Aside from their very limited use in house paints solutions of these resins are being used successfully in large quantities in many types of finishing, ranging in application from sprayed freight cars and trucks to tumbled shoe-eyelets and rolled lithographic inks. More will be said about these resins in subsequent articles.

Newer Resin Coatings

Another and very important class of newly developed resin coatings introduced into this country from abroad are those which are essentially combinations of the alkyd type with the phenol-formaldehyde resins. The resins resulting from this combination have had a tremendous growth in the past two years. They are manufactured in this country by one company. Their field of application is wide and in some instances competitive with the alkyd resins. For some special purposes, such as water and chemical resistance, they are at present in a class by themselves, in their price range. Coatings made from these resin solutions have very excellent adhesion to metal and are capable of withstanding quite rough usage. They might be described as responsive resins, in that their final film characteristics may be changed greatly by various baking schedules and by admixtures with other types of resins to give desirable special properties such as extreme

heat resistance, otherwise unobtainable. Like most synthetic mixtures on high baking they yellow appreciably—more so than the straight alkyd resins. This makes light colors difficult. These resins are also available in a form for use with nitrocellulose to which they give desirable properties of flexibility and adhesion. Other resins developed in the last decade are the vinyl group. These are valuable for special types of coatings and are still in the development stage.

In this and the preceding article we have endeavored to present a survey of the historical transition of coating materials from the earliest crude compounds composed of natural products to the present age of artificial or synthetic mixtures. There is no doubt but that man has improved on nature, first of all in imitating her products, and then in improving them by chemically combining entirely unrelated products. In one field alone has nature retained her supremacy and that is in the field of drying oils. Man still depends on linseed oil for paints and on chinawood oil for the best varnishes. This has been called the speed age, and it is in this respect primarily where we have made our greatest accomplishments. Under natural processes, thousands of years of time and special atmospheric conditions were necessary for the sap of a tree to be converted into a fossil gum suitable for a varnish. And such a varnish required days to dry. Now, in a metal container, from such diverse materials as carbolic acid and formaldehyde, or glycerine and phthalic acid, or cotton and acids, man can produce a variety of different varnish gums in a few hours. And the drying time of some of these can be measured almost in seconds. Without our modern coating materials, every-day objects about us on which we are so dependent would be impossible.

Coating Terms

In following articles the major classes of coating materials as they now exist will be described. To prepare for these a list of the essential terms used in the coating field is given. There is a wide divergence in the nomenclature which exists of the various materials and operations used by the modern finisher. It is felt that for purposes of clarity in these writings, terms and definitions should be established for our use. These are not intended to be a Webster's Dictionary of coating terms but are simply those which we will employ.

Lacquer—a clear unpigmented solution containing essentially nitro-cellulose as the film forming ingredient.

Pigmented lacquer—the same, pigmented or colored.

Cotton—nitrated cellulose.

Varnish—A solution of a natural gum combined by heat with a drying oil.

Resin varnish—A solution of a synthetic resin combined by heat with a drying oil.

Synthetic varnish—a solution of a synthetic resin in a solvent.

Enamel—Either a varnish or a resin varnish combined with pigment.

Synthetic enamel—a synthetic varnish combined with pigment.

Primer—a clear undercoating to be followed by a color coat.

Solvent—an organic liquid which will completely dissolve a gum, resin or cotton, to form a true solution.

Thinner—an organic liquid compatible in small or large amounts with gum, a resin, or cotton solution to give a desired viscosity.

Driers—Metals added to paints or any of the three classes of varnish to speed the drying.

Pigment—a ground mineral powder to be incorporated with a coating to give color.

Coverage—the property of a pigmented coating to hide the surface.

Cure—The property of conversion by heat to secure either a higher melting point or to render infusible.

Air-dry—the elimination of thinners or solvents by evaporation at atmospheric temperature.

Force dry—the elimination of thinners and solvents by the use of temperatures higher than atmospheric.

Tests for Cellulose

By W. M. Billing, Ph. D.

THE method approved by the Committee on the Viscosity of Cellulose, Division of Cellulose Chemistry, American Chemical Society is followed with certain modifications.

Preparation of Solvent:

The solvent used in the viscosity determination is cuprammonium hydroxide solution containing

30 + 0.5 g. Copper per liter.

165 + 2.0 g. NH_3 per liter. (Direct titration)

10 g. (approximately) sucrose per liter.

The solvent of the above specifications is prepared by the following procedure:

A water jacketed glass tube, preferably four to six inches in diameter, is loosely packed with clean small diameter copper wire, copper turnings or copper nails, and is filled to within six to eight inches of the top with *C. P.* concentrated NH_4OH (28% NH_3 minimum) containing 10 g. sucrose per liter. Air is bubbled through the column at such a rate as to give a copper concentration of 32-35 g. Cu per l. in from three to five hours. The rate will be determined largely by experience, but a flow-meter is useful in establishing, and following a standard procedure. The water jacket is used to maintain the temperature during blowing at 20-25° C.

The solution is drained from the tube and allowed to settle for twenty-four hours if practical. At the end of this time the supernatant liquid is syphoned off and diluted to the standard concentration of Cu on NH_3 . Storage at this and all other times should be in a cool, dark place.

The copper content is determined by titration against fifth normal sodium thiosulfate solution. Ten cc. of the cuprammonium solution is pipetted into a 500 cc. Erlenmeyer flask containing a little distilled water and a few glass beads to prevent bumping. The flask is placed over stove or burner and boiled until there is no more ammonia given off. HNO_3 (1:1) is added until the copper is in solution as indicated by change to a clear green-blue color and the solution boiled down to a low volume. Seven per cent. (approximate) NaOH is added until the acid is neutralized and a precipitate forms, the contents boiled for about one-half minute and concentrated acetic acid added until all copper is in solution. This solution is allowed to come to a boil, removed from the source of heat, and cooled; 15 to 20 cc. of saturated KI solution is added (150 grams per liter), fifth normal thiosulfate run in to the 20 cc. mark and a little starch solution added. The titration is then continued until the blue color from the starch has disappeared. The end point usually occurs at the first appearance of a creamy white color.

No. cc. thio. \times Normal Factor \times 6.357 = grams per liter of copper.

The copper may also be determined by evaporating the solution and burning to cupric oxide, by titration against KCN solution, or by electrolytic methods.

The ammonia content is determined by neutralizing 2 cc. of the solution in 50 cc. $\text{N}/2$ H_2SO_4 and titrating the excess acid with $\text{N}/2$ NaOH, using Methyl Orange or Methyl Red as indicator. Care should be taken to see that no solution adheres to the outside of the pipette when the sample is taken, in a pipette, and also that the end of the pipette is always below the surface

Standard methods of analysis as developed and modified by the Research Department of the Hercules Powder Company.

of the acid while delivering. The NH_3 content is calculated as follows:

$$(50 - \text{cc. NaOH}) \times 4.25 = \text{NH}_3 \text{ in g.p.l.}$$

The calculation assumes the total alkalinity to be due to NH_3 . This is incorrect, since there is copper present, which has a definite alkalinity; therefore, in the finished solution (30 g.p.l. Cu) there is only 149 g.p.l. NH_3 present. This is a deviation from the A. C. S. method, but the variation introduced is largely compensated for elsewhere in the method; therefore, it is satisfactory to use solutions of this strength.

To adjust the strength of the solution to the required copper and ammonia content, it is necessary to dilute it with concentrated NH_4OH and with water. Rather than formulate an elaborate set of equations for the dilution of the cuprammonium solution, two samples will be worked out, covering the cases usually met. (1) With both copper and ammonia content too high, (2) with copper content too high and ammonia content too low.

(1) Assume the following preliminary analysis on two liters of solution:

Copper 35.0 g. per liter

NH_3 180.0 g. per liter

To reduce the copper content to 30.0 g. per liter, let V_i be the new total volume of solution.

$$\text{Then } V_i \times 30.0 = 2.0 \times 35.0$$

$$V_i = 2.333 \text{ liters}$$

2333 - 2000 = 333 cc. of LIQUID to be added, to reduce the copper content to 30.0 g. per liter.

The ammonia content must also be reduced to 165 g. per liter. Taking V_i , or 2.333 liters, as the new total volume, the total ammonia content of such a solution should be:

$$2.333 \times 165.0 = 385 \text{ g. of } \text{NH}_3.$$

There are now present in the two liters of solution;

$$2.0 \times 180 = 360 \text{ g. } \text{NH}_3$$

$$385.0 - 360.0 = 25.0 \text{ g. of } \text{NH}_3 \text{ to be added.}$$

Assuming the ammonia content of concentrated NH_4OH to be 250 g/l or 0.25 g/cc., then the volume of NH_4OH to add would be:

$$\frac{25.0}{0.25} = 100 \text{ cc.}$$

As the total volume of LIQUID to be added was 333 cc., 333 - 100 = 233 cc. of water to be added.

(2) Assume the following preliminary analysis on two liters of solution:

Copper 35.0 g. per liter

NH_3 155.0 g.

To reduce the copper content to 30.0 g. per liter, the new total volume must be 2333 cc. The total ammonia content of this new column should be 385.0 g. (Example No. 1)

Actually, there are present:

$$2.0 \times 155 = 310.0 \text{ g. } \text{NH}_3$$

$$385.0 - 310.0 = 75.0 \text{ g. of } \text{NH}_3 \text{ to be added}$$

$$\frac{75.0}{0.25} = 300 \text{ cc. of conc. } \text{NH}_4\text{OH} \text{ to be added}$$

$$0.25 = 333 - 300 = 33 \text{ cc. of water to be added.}$$

Apparatus Required—Specifications of Essentials

Solution Bulb: The bulb used for dissolving the sample is about 17 cm. in overall length and 5 cm. in diameter at the largest part. The upper end is so made that it takes a No. 4 solid rubber stopper. The lower end is drawn out into a tube about 1 cm. in diameter. The length of the bulb proper is about 10 cm.

Viscometer: The falling sphere viscometer consists of a tube 30 cm. or more in length and 1.4 + .05 cm. in inside diameter.

A circular mark is etched every 5 cm. This viscometer is kept in a water jacket which is maintained at 25° C.

Spheres: The spheres used are ground glass beads. The A. C. S. method calls for beads $\frac{1}{8}$ inch (3.175 mm.) in diameter. These beads should have a specific gravity between 2.4 and 2.6 and must be individually calibrated by dropping through a liquid of known viscosity, using the standard viscometer. Results obtained with these beads must be reported in poises to be comparable with results obtained elsewhere. A more accurate procedure is to select a "standard" sphere (3.17 mm. dia. 2.45 sp. gr.) and make all other glass spheres have the same time of fall through standard castor oil. Spheres of gravities other than 2.45 are ground to the diameter which corresponds to their gravity according to Ladenburg's modification of Stokes Law. This law is as follows:

$$9\eta S (1 + 2.4X)(1 + 3.3 r/h) = 2 g \cdot r^2(d_1 - d_0)/T \text{ where:}$$

η = Viscosity of the liquid

S = Distance fallen through in time T

r = Radius of the sphere

d_1 = Density of the sphere

d_0 = Density of the liquid

g = Acceleration due to gravity

h = Height of liquid in the tube

X = Ratio of the radius of the sphere to the radius of the tube.

For the "standard" sphere and viscometer:

$$r = 1.585 \text{ mm.} \quad d_1 = 2.45$$

d_0 = for cuprammonia solutions of cellulose as we prepare them = .995.

$$h = 225 \text{ mm.} \quad X = 1.585/7.0$$

Filling Equipment: The equipment used for filling the bulbs consists of a 97 cc. automatic pipette so arranged that the solution bulb, when attached, may be flushed with hydrogen.

Shaking: The bulbs are attached to a wheel which rotates at a speed of 8 r.p.m. A water bath at 25° C. surrounds this wheel, the whole assembly being kept out of direct sunlight.

Procedure: A six to eight gram sample of the cotton is placed in a tin can and dried two hours in an oven at 105-110° C. This is a departure from the A. C. S. method but saves time through not having to air condition samples; therefore, they are dried, although this procedure lowers the viscosity somewhat. This drying should be carefully controlled, as longer drying, or drying at higher temperatures lowers the viscosity excessively. The cans are removed from the oven, covered with a tight fitting cover and placed in a desiccator until cool. The viscosity range of the sample determines the weight of sample to be used. For very high viscosity cotton use one gram of sample (1/5 concentration), for very low viscosity material use 5 grams (full concentration), for viscosities between these two extremes use 2 1/2 grams (1/2 concentration). The 1/2 concentration range is the one most often used. In weighing the sample a tared glass weighing bottle is used. The bulk of the sample is quickly introduced into the bottle and the cover applied. The weight of sample is then adjusted by placing the rest of the sample on top of the bottle. In this way only a small part of the sample is exposed to the moisture of the air during weighing. This precaution is necessary, because a 1% error in concentration of sample may produce a 5% error in the final viscosity.

The weighed sample is placed in the solution bulb and the bulb closed with a No. 4 rubber stopper which has been dipped in water and subsequently wiped. The small end of the bulb carries a short piece of rubber tubing, the tubing having been wired on so as to form a very tight connection. This bulb is then attached to the filling apparatus, evacuated and flushed at least twice with hydrogen,* then evacuated again. The pipette, holding 100 cc. of solution, is now filled to the top and then stopcock manipulated so that 97 cc. of solution is drawn into the bulb. The tube is kept filled with solution at all times. The

*Hydrogen, if as pure as 99.8% need not be purified by bubbling through alkaline pyrogallol acid. It should be conducted through a mercury regulator set at 4-5 cm. mercury; this pressure will compensate for the presence of the water in the bath and will prevent passage of either air or water in the bulb.

solution is now forced down into the bulb by turning stopcock to hydrogen and opening stopcock for a moment. This fills the bulb with hydrogen. Screw clamp is now closed, the bulb detached, and the contents thoroughly mixed by shaking for fifteen hours. This shaking is done on the wheel described under "Apparatus."

At the end of the shaking period the bulb is removed from the wheel and the viscometer tube filled with solution by connecting bulb and the bottom of the viscometer.

Air pressure is applied to bulb in order to force the solution into the viscometer. It has been shown that air at this stage does no harm provided it does not pass through the solution. A glass sphere of the characteristics described under apparatus is dropped through the center of the solution and the time of fall for 20 cm. taken by means of a stop watch. It is important that the viscometer tube be perpendicular and that the bead be dropped through the center, as otherwise the bead will "drag" on the wall of the tube.

The time of fall of two or more spheres through the same solution is taken and their average reported as the viscosity of the sample. The concentration of sample used is also stated.

Soda Soluble

Reagents. NaOH. Dissolve about 80-85 grams of C.P. NaOH in 100 cc. of distilled water, and allow to settle over night or longer. Decant the clear liquid and make up to approximately one liter. Determine the concentration by titration with a standard acid and adjust the strength of the solution until it contains 7.14% (+0.05%) NaOH. Store in a well stoppered bottle. A rubber stopper is to be preferred. The NaOH solution may also be made from liquid caustic of 50% strength.

Procedure. Approximately 2.0 grams of air-dry material are weighed into a ground glass-stoppered weighing dish or covered aluminum can, dried for two hours or to constant weight in an oven at 100°-105° C., then transferred to a 250 cc. Erlenmeyer flask. The weight of material is then obtained by weighing back the empty dish.

Add 100 cc. of the NaOH solution, and connect the flask to a reflux condenser. An air condenser, consisting of a 3 ft. piece of 6-8 mm. glass tubing inserted in a rubber stopper, may be used instead. Concentration of the alkali solution and exposure of the alkali-soaked fibre to the air must be avoided.

The flask is then immersed in a container of boiling water for a period of three hours. To get comparable results, the contents of the flask must be kept at 99° C. (+1.0°) for the specified time. A deviation in temperature has an appreciable effect upon the results.

The contents of the flask are then neutralized with 25 cc. glacial acetic acid and transferred quantitatively to a 600 cc. beaker. The excess acid is necessary to break up the combination of alkali and cellulose.

The solution is then filtered through a Gooch crucible, allowing the undissolved material to take the place of the usual asbestos mat. If any fibres are present in the filtrate, it is poured through the crucible a second time. Wash the contents of the crucible with about 750 cc. of distilled water, or until the washings are acid free, as indicated by litmus papers. Transfer the contents of the crucible to a weighing bottle. Dry the bottle and contents at 100°-105° C. over night, cool in a desiccator, and weigh. The loss in weight represents the soda soluble portion of the material.

$$\frac{\text{Weight of Soda Soluble Portion X 100}}{\text{Weight of Sample}} = \% \text{ Soda Soluble}$$

Ash

A sample of convenient size (5 to 20-grams) of dried material from the moisture determination is burned in a weighed porcelain dish of suitable size. The carbon is burned off at red heat in a muffle furnace. The dish is cooled in a desiccator and weighed. The difference in weight is calculated and reported as follows:

$$\frac{\text{Weight of Ash X 100}}{\text{Weight of Sample}} = \% \text{ Ash}$$

In routine control analysis, it is satisfactory to assume the moisture content as 5% and weigh out 21 grams of air-dried material for the determination. The results may then be calculated as follows:

$$\text{Weight for Ash X 5} = \% \text{ of Ash}$$

For more accurate results a 30 gram sample in a 96 mm. diameter porcelain crucible may be used.

Ether Extract

Two to ten grams of dried material are extracted with ethyl ether for eight hours, or over night in a Soxhlet (or Wiley) apparatus. The ether in the previously tared extraction flask is evaporated on the steam bath, the flask is heated in a 100° C. oven until the final traces of ether and moisture are driven off (15 to 30 minutes should be sufficient), cooled in a desiccator for 30-45 minutes, and weighed. If a Wiley apparatus is used for the extraction, the ether solution is transferred to a small tared beaker for the evaporation and subsequent weighing.

The ether employed in this determination should have a low non-volatile matter content, otherwise a blank should be run on a portion of the same volume as used in the extraction.

$$\frac{\text{Weight of Extract X 100}}{\text{Weight of Sample}} = \% \text{ Ether Extract}$$

Sulfuric Acid Insoluble

A 5.3 gram air-dry sample (equivalent to 5.0 grams dry cotton on a 5% moisture basis) is weighed into a 250 cc. beaker. One hundred cc. of 72 + 1% H₂SO₄ are added, the contents mixed well and allowed to stand for about four hours, or until cellulose is thoroughly in solution with occasional stirring.

The contents of the beaker are transferred quantitatively to a 1.5 liter beaker containing about 1 liter of cold distilled water, covered with a watch glass and heated at 100° C. for a period of four hours by suitable means, such as a boiling water bath, or an electric hot plate. The contents are stirred at intervals during the heating. Boiling should be avoided, as this tends to break up the coagulated material into a colloidal form.

The solution is filtered through a Gooch crucible having a thin asbestos mat. For samples containing appreciable amounts of insoluble matter, loose asbestos may be placed in the crucible above the mat to facilitate filtering. When using crucibles prepared and weighed before filtering there may be a loss and not a gain in weight during filtering. For samples of low insoluble content and almost negligible inorganic insoluble content, it has been found best to filter through an unweighed Gooch crucible having an asbestos mat (and if necessary loose asbestos) which has been heated to bright red heat in a muffle furnace to burn off all organic matter. After filtering, the crucible and contents are washed with hot water until the washings are free from acid when tested with methyl orange indicator. The crucible is dried in an oven at 100-105° C. overnight, cooled in a desiccator, and weighed. It is then placed in a muffle furnace until all organic matter has burned, cooled in a desiccator and weighed again.

$$\frac{\text{Loss in Weight of Crucible X 100}}{\text{Weight of Sample}} = \% \text{ Sulfuric Insoluble}$$

For 5.3 g. air-dry (5 g. dry) sample:

$$\frac{\text{Loss in Weight of Crucible X 100}}{5} = \% \text{ Sulfuric Insoluble}$$

Note: Concentrated C.P. H₂SO₄ (95% strength) may be used in place of the 72% H₂SO₄. In this case 5.3 grams of air-dry material are heated for two hours at 105° C. and transferred in a closed container to a desiccator until cool. The sample is transferred to a 250 cc. beaker, kept cool in a water bath and 50 cc. of 95% H₂SO₄ added with vigorous stirring. The beaker must be kept dry and cool; otherwise, overheating and charring of the sample may result. The stirring is continued for five minutes. At the end of this time the contents are transferred to a 1.5 liter beaker containing one liter of distilled water as in the regular method.

Note: The copper number by the Marquerol method may be calculated from the 7.14% soda soluble as follows:

$$\text{Copper Number} = 7.14\% \text{ Soda Soluble} \times 0.1 - 0.1.$$

The copper number is the number of grams of copper reduced by 100 grams of cellulose.

Reagents

- Copper Sulfate Solution, 100 g. of crystallized C. P. CuSO₄·5H₂O per liter.
- Alkaline Solution, 50 g. of C.P. NaHCO₃ and 350 g. C.P. crystallized Na₂CO₃·10H₂O in one liter of water.
- Ferric Sulfate Solution, 50 g. of C.P. Fe₂(SO₄)₃, 140 cc. of 95% H₂SO₄ and 1 liter of distilled water. Add the Fe₂(SO₄)₃ to the water, then slowly pour in the required amount of H₂SO₄. A blank determination must be run with standard KMnO₄ to determine the slight reducing power of this solution, and the correction applied to the final titration.
- KMnO₄ Solution. Dissolve about 1.0-1.5 g. of C.P. KMnO₄ in a liter of water, and standardize with sodium oxalate.

Procedure. The sample must be well torn apart and thoroughly mixed to obtain accurate results. Weigh out 2.63 g. of air-dry material into a 100 cc. or 125 cc. Erlenmeyer flask. Assuming the material to contain 5% moisture, the dry weight would be 2.5 g. Mix 5 cc. of the CuSO₄ solution and 95 cc. of the alkaline solution, heat to boiling, then pour into the flask containing the sample. Cover the mouth of the flask with a porcelain disc, watchglass or small funnel and heat for three hours in a boiling water bath. If desired, the flask may be placed on a steam bath and covered with a large beaker.

The solution is then filtered rapidly, care being taken not to allow the sample to dry in the presence of air, otherwise oxidation of the precipitated cuprous oxide will take place. A double funnel arrangement, is convenient for this purpose. The upper funnel contains a perforated disc, the lower a coarse filter paper. A small Buchner may be used in place of the upper funnel and a Gooch crucible containing a thick mat of glass wool or a thin mat of asbestos substituted for the lower. Decant the hot liquid through the lower funnel and transfer the sample and precipitated Cu₂O to the upper funnel. Quickly wash the flask and sample with about 200 cc. of boiling water containing a little Na₂CO₃. It is unnecessary to wash out all the CuSO₄, as this salt does not interfere in the final titration. Squeeze the sample as dry as possible with a stirring rod, then transfer to a 500 cc. flask containing about 100 cc. of previously boiled and cooled distilled water.

By means of a pipette, add 5 cc. of the Fe₂(SO₄)₃ solution to the original 100 cc. flask, dilute, and pour through the upper funnel, allowing the filtrate to run into the 500 cc. flask containing the sample. Rinse the 100 cc. flask and filter through the same funnel. Stir the contents of the 500 cc. flask, and allow to stand until all the Cu₂O is in solution. This time varies with the nature of the sample, five minutes usually being sufficient for chemical cotton while fifteen hours are sometimes required for hard surface wood pulps.

Titrate the solution with standard KMnO₄ solution to within a few drops of the end-point. If desired, the solution may then be filtered, the end-point being easier to detect in the absence of the sample. The same results are obtained, however, by titrating directly. In either case, the end-point is taken when the pink color remains for at least thirty seconds.

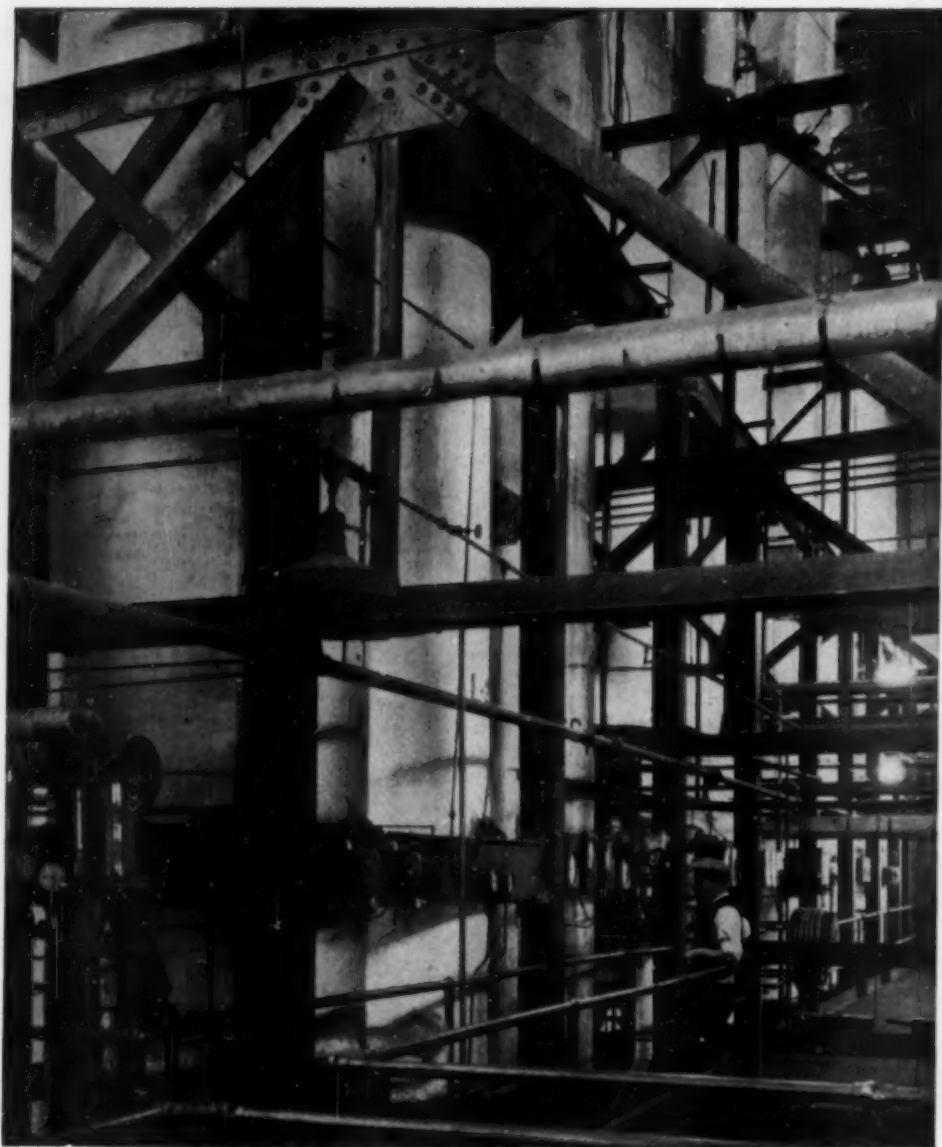
(Total cc. KMnO₄ - cc. for Fer)

$$\frac{[(\text{SO}_4)_3 \text{ Blank}] \times \text{N.F.} \times 6.357}{\text{Weight of Sample}} = \text{Copper Number}$$

For convenience in calculation, the KMnO₄ solution may be made up to a definite strength. Exactly 1.25 g. of C.P. KMnO₄ are made up to a liter in a volumetric flask, and this solution used in the titration. If 2.63 g. of air-dry material are then used, the calculation is as follows:

(Total cc. KMnO₄ - cc. for

$$(\text{Fe}_2(\text{SO}_4)_3 \text{ Blank}) \times 0.10 = \text{Copper Number}$$



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Applications of Vinyl Resins

J. G. Davidson and H. B. McClure

Development Laboratory, Carbide and Carbon Chemicals Corporation,
Mellon Institute of Industrial Research, Pittsburgh, Pa.

THE rapid growth of the synthetic resin industry, especially during the last ten years, has commanded general attention. While many new products have emerged from the research laboratories to find their places in this expanding industry, a definite need has existed for a new type of resin possessing unusual properties for application in many of the possible uses that have appeared during this period. To meet such a need, the vinyl resins have been brought to a high degree of commercial development under the name "Vinylite" (trade-mark registered) and form the subject of the present discussion.

CLASSIFICATION OF SYNTHETIC RESINS

Synthetic resins may be roughly classified according to their general methods of manufacture, and from this standpoint two types may be distinguished, namely, condensation and polymerization resins. Condensation resins are formed from the interaction of two or more different compounds yielding essentially new molecules, while polymerization resins result from the reaction of the molecules of one compound with each other. In many instances, both types of reactions are involved, as with phenol-formaldehyde, urea-formaldehyde and glycerol-phthalic anhydride resins. Each class has its own general characteristics, good and bad features, and applications. Vinyl resins are related more closely to the polymerization group, since they do not change their chemical state when heated.

Plastic materials may be further subdivided into two broad types designated, respectively, thermosetting and thermoplastic. As examples of the former, the phenol-formaldehyde and the urea-formaldehyde resins may be cited. The chemical reaction involved in their preparation is not completed in the production of the molding powders. In this form they are thermoplastic and may, by the application of heat and pressure, be readily pressed in a mold to the desired shape. When the heated mold attains the proper temperature, the chemical reaction is completed and an infusible product is obtained.

The thermoplastic resins—viz., cellulose nitrate, cellulose acetate, and shellac—may be formed and re-formed many

Vinyl resins, resulting from the polymerization of vinyl compounds by the action of catalysts or ultra-violet light, have been known for many years. However, they lacked proper physical properties for commercial application until the recent development of new and improved varieties of resin which have been introduced under the trade-name "Vinylite."

Vinyl resins are colorless, odorless, tasteless, noninflammable, and may be colored any shade with dyes or pigments. The pure resins are transparent, but any degree of opacity is attainable by the incorporation of fillers. Methods of molding are described. The resins may be sheeted by calendering and may also be extruded as rods or tubes. Solutions of the resins in solvents that are mostly of a ketonic nature are used to impregnate porous media, such as paper and textiles, which can, after drying, be applied to rigid surfaces by hot pressing. Properly formulated solutions of certain vinyl resins may advantageously be used as lacquers, in which no cellulose ester or other resin is necessary, to form tough, stable, and chemically resistant protective coatings.

Some of these resins are suitable for the manufacture of dentures, while other varieties are used in making phonograph records. On account of the low shrinkage of vinyl resins, very large objects such as doors or wall panels can be molded easily and successfully. The application of Vinylite resins to the construction of a three-room apartment is described.

The use of catalysts, such as benzoyl peroxide, to bring about polymerization was described by Klatte and Rollett (5) in 1917. Later, Plotnikow (8) made photochemical studies on the polymerization of vinyl chloride, and Flumiani (4) in 1926 discussed the degree of dispersion of the solutions of the vinyl halide polymers. Many patents (1) have been granted, in which a host of vinyl polymers, special methods of producing them, and their applications are described. The Vinylite resins are made by polymerization of various vinyl compounds under appropriate conditions.

CHEMICAL FORMATION OF VINYL RESINS

Because vinyl resins, based upon the polymerization of vinyl compounds (characterized by the double bond group $-\text{CH}=\text{CH}_2$) are so old, we cannot here add materially to the chemistry of their formation. The literature on the subject is profuse and contains multitudes of references to methods, varying chiefly in detail of accomplishing the polymerization

times into definite shapes by the application of heat and pressure, provided sufficient plasticizing agent is present to impart the proper flow. No chemical reaction takes place during heating; hence the material remains in the plastic state as long as the temperature is maintained. When used in molding operations thermoplastic resins are heated to the softening point, pressure is applied, the mold cooled and the casting removed. The Vinylite resins belong in this class, as they are inherently thermoplastic and remain permanently so without the necessity of incorporating plasticizers.

HISTORY OF VINYL RESINS

Their history goes back to 1838. At that time Regnault (9) observed the formation of a white powder when sealed tubes of vinyl chloride stood in the sunlight. In 1872, E. Bauman (2) polymerized the vinyl halides to white solid masses, "unaffected by solvents or acids." It was not until 1912 that Ostromislensky (6, 7) pointed out that polymerized vinyl bromide resembled the bromide of "butadiene rubber" and that it existed in several modifications. In the same year patents (1) were granted him on the production of rubberlike masses from polymerized vinyl halides.



PLATE 1. GROUP OF MULTICOLORED OBJECTS MOLDED IN VINYLITE RESIN. MOTTLED SHEETS BEHIND STEERING WHEEL. COSMETIC JARS, CIGARETTE BOXES, AND COLOR DISKS IN FOREGROUND

of vinyl molecules. This occurs so readily as to be almost spontaneous. Light, heat, and oxidizing agents (particularly organic and inorganic peroxides) accelerate it. The resulting resinous masses vary in properties through a wide range from rubbery materials to hard, brittle resins, depending upon which variety of vinyl compounds is used as the raw material. The recent commercial development of unsaturated derivatives of ethylene, on the one hand, and acetylene, on the other, make available many compounds from which to choose raw materials for resin manufacture (vinyl halides, alcohols, esters, etc.).

Like all resinifying reactions, that which forms vinyl resins is imperfectly understood and one must rely solely upon speculation for explanations of what actually occurs and what the exact chemical constitution of the finished resin is. Many theories have been advanced, notably by Staudinger (10), Ellis (3) and others.

Here, however, we seek to avoid repetition of these details and variations and will confine what follows to the utility characteristics of resins of this type developed by the commercial research division of the authors' company.

UTILITY CHARACTERISTICS OF VINYL RESINS

The Vinylite resins are odorless, tasteless, chemically inert, and all except the type known as Vinylite A are non-inflammable. They are produced as granular powders,

either white and opaque or transparent and colorless. They may readily be compounded with organic or inorganic fillers and with dyes or pigments to produce molding compounds of practically any color or shade. As the resin is chemically inert, the dyes and pigments do not suffer in color value during the molding process, provided they are themselves stable at the compounding and molding temperatures. Some of the more important physical properties of pure Vinylite 0110 resin are set forth in Table I.

Three general types of molding compounds may be prepared—transparent, translucent, and opaque—depending upon the choice and quantity of filler, dye, or pigment used. These molding compounds may be preformed or compressed into small tablets, bars, or disks at room temperatures by an ordinary tableting or preforming machine. The preforming operation is merely to compress the loose, somewhat fluffy powder into a form more readily handled, plus the fact that, once it has been determined that a certain number of preforms or disks is necessary to charge a mold, it is a simple matter to keep track of the amount of material required to load the mold properly by merely charging the same number of disks or preforms each time.

Certain shapes, such as tubes and rods, may be more readily produced by extrusion processes than by molding, particularly if the pieces are long. This ability to extrude the molding compound is of special commercial significance. The pure resins themselves and all types of Vinylite molding compounds may be obtained as thin sheets by the use of hot calendering rolls, such as are used in the rubber industry, or failing this the sheets may be produced by pressing the resin or compound between polished plates in a heated press. Beautiful and striking color effects may be secured by mixing the various colored resins or compounds while calendering or previous to pressing the sheets. (See Plate 1.) The Vinylite resins are inherently tough and resilient but for some industrial applications for which a very soft rubbery product is desired, plasticizers are added to the resins in sufficient proportion to give the desired effect.

Since the Vinylite resins are permanently thermoplastic, the molding operation is comparatively simple. The molding powder is heated to the proper temperature in the mold or on a steam table. In the latter case the mold is then charged, and in either case it is closed and full pressure applied. The mold of course must then be cooled below the initial softening point of the plastic before it is opened and the casting removed. Since the mold is closed and full pressure built up very quickly, the molding cycle is chiefly determined by the time required for heating and cooling the mold. It should be so constructed that the steam and water passages for heating and cooling are drilled as close to the cavities as possible without weakening the design. Furthermore, these passages should be so arranged that all parts of the mold can be heated or cooled at a uniform rate, thus avoiding temperature differentials within the mold itself. All parts of the mold coming in contact with the finished casting must be either chromium-plated or otherwise very carefully finished, as the Vinylite casting will minutely and faithfully reproduce every mark and line on the metal surface.

Vinylite molding compounds may be successfully handled in the flash type molds customarily used in molding Bakelite, cellulose acetate, or shellac, except that shrinkage is less and therefore greater draft allowances should be made. Pure

¹ The word "casting" as used throughout the article denotes the molded object.

or unfilled Vinylite resins must be handled differently. If a flash type mold is used, the unfilled resin being quite fluid at molding temperatures merely flows out of the flash groove until the mold is completely closed. It is obvious that sufficient pressure cannot be applied to the very fluid mass to produce proper densification. Castings molded under these conditions do not have the proper mechanical strength and have some tendency to return to the shape they possessed before molding, particularly if reheated. This condition does not arise in the molding of Vinylite compound because the inert filler increases the viscosity of the heated material being molded to such an extent that flow through the flash groove is quite difficult and therefore sufficient pressure can be applied to produce a good casting.

For the above reason a positive or semipositive mold must be used for the production of good castings from pure Vinylite resin. A positive mold has no provision whatever for overflow or flash. The top part of the mold or "force" fits very closely into the bottom or cavity and there is no opportunity for any material in the cavity to escape. It is obvious that under these conditions full pressure can readily be applied, even to the most fluid resin, but in order to produce a casting of the same dimensions and density every time, it is necessary to load the mold very carefully with a quantity of resin that has been accurately weighed each time. Castings so molded are very strong and resilient, have no internal strains, and no tendency to unmold even when reheated.

In most cases unfilled Vinylite resin can best be molded in a semipositive mold. In this type, the top part of the mold (force) fits closely into the lower or cavity section but a small channel or spew hole is drilled into the cavity so that a certain amount of flow is possible in the mold. The degree of flow can be readily controlled by the location, size, and placement of the spew hole. With such an arrangement, because of the resistance to the flow of resin through the spew hole, any desired pressure can be built up in the mold, thus resulting in castings free from surface marks, internal strain and other objections. The semipositive mold has two advantages over the positive mold: first, it is not necessary to charge the mold so accurately; and secondly, a certain amount of flow within the mold is desirable.

Generally speaking, molds intended for use with Vinylite resins, either filled or unfilled, are machined from steel that is later hardened. In many cases, however, hard alloy steel can be used without subsequent treatment. Vinylite dentures, on the other hand, are molded in plaster of Paris, since on account of numerous undercuts the mold must be broken to remove the finished denture.

The molding temperatures and pressures are dependent upon the type and size of casting and the variety of resin used. The filled resins have been molded at pressures between 250 and 2000 lb. per sq. in. and temperatures of 120° to 150° C. (250° to 300° F.), while the unfilled resins require pressures of 1200 to 1800 lb. per sq. in. and temperatures of 115° to 130° C. (240° to 260° F.).

The permanent thermoplasticity of the Vinylite resins offers definite economies in the molding shop. Practically all scrap or "flash" may be reused. Defective castings can be replaced in the mold with additional molding compound and remolded. The application of these resins to scheduled production has definitely shown that the total loss of material is less than 1 per cent when ordinary care is taken to eliminate dirt from the scrap. This elimination of material loss is of importance in all molding operations and a

pre-requisite in many. For example, in the manufacture of sound reproducing records, the flash or scrap may amount to 25 to 30 per cent which, if not re-usable, would present a prohibitive material cost. The moldability and physical properties of Vinylite resin are not altered by repeated molding, provided the temperatures have not exceeded 150° C. (300° F.).

It is relatively easy to produce small castings from almost any plastic, but very large castings are difficult, if not impossible, in most cases because practically all resins, particularly the thermosetting type, shrink after removal from the mold and therefore set up internal strains that cause warping, cracks, and fractures. In contradistinction to this situation, Vinylite panels 2 in. × 2.5 ft. × 8 ft. have repeatedly been produced without difficulty. These castings weigh about 150 lb. each, and are, so far as known, the largest castings ever made from any of the usual plastic materials. None of these castings have cracked, warped, or otherwise deteriorated over a period of approximately one year.

One of the most rigid requirements of a plastic is its use as a denture material. A resin for this purpose should be odorless, tasteless, unaffected by continuous contact with moisture, weak acids, and alkalies, mechanically strong, should permit molding in a plaster mold to accurate and intricate form, and should be capable of repeated repair by remolding. After several years of effort a type of pure Vinylite resin, to which nothing but a small amount of pigment has been added,



PLATE 2. MULTIPLE DENTURE CASTING OF VINYLITE RESIN AS REMOVED FROM MOLD, BEFORE REMOVAL OF "FLASH." PEARL-ESSENT TUMBLERS AND CIGARETTE BOX ARE STANDING ON CHINTZ IMPREGNATED WITH VINYLITE, HOT PRESSED ON COMPOSITION BOARD



PLATE 3. LIVING ROOM. THE FOLLOWING OBJECTS MOLDED OF VINYLITE RESIN ARE VISIBLE: TILING OF ALL THREE ROOMS, WALL PANELS, DOORS, CUPS, DISHES, CIGARETTE BOXES, AND DOORKNOBS

has been produced that is eminently satisfactory for dentures. The material has been placed on the market within the last six months by two of the large dental manufacturing companies and their experience has fully justified its use. The denture blanks, both uppers and lowers, are produced in a gang type mold. (See Plate 2 which also shows some of the individual dentures.)

The fact that these resins are odorless and tasteless recommends their use specifically as containers for food products, cosmetics, and beverages, for shock resistant drinking glasses, and for any other use that will not bring the molded object into prolonged contact with boiling water. Not only can they be molded in any color, but a beautiful opalescent effect can be secured by the introduction of small amounts of aluminum bronze or "fish essence" in the pure resin. A number of tumblers and some cosmetic jars made of this nacreous material are shown on Color Plates 1 and 2.

One of the large phonograph companies has for several years been using a special type of Vinylite developed exclusively for its use in the production of long playing records. These records are produced in the same type of mold used for the pressing of shellac records, although the molding cycle is quite different. Vinylite produces a thin and flexible record that does not warp, even in very warm climates, nor do high humidities affect its wearing qualities (one of the chief objections to shellac records), and the microscopic fidelity with

which it reproduces the sound track is of extreme importance in this case. A resin that changed its dimensions after molding would completely destroy the tonal qualities of the record.

Metal, wood, composition board, and similar products may be completely surfaced with Vinylite molding compound. With metal it is simply necessary to etch or sand-blast the surface and then press on a preformed sheet. With cellular products, such as wood and Celotex, for which low molding pressures are essential, previously prepared Vinylite sheeting may be used instead of the molding compounds. Thin sheets of the resin furnish an excellent waterproof bond for applying wood veneer to various types of backing. The pressures and temperatures necessary to effect this bond are not detrimental to the veneer. A somewhat novel effect may be secured by impregnating cloth or decorative paper with Vinylite, drying and pressing the material to some type of backing in a heated press. Inasmuch as this resin is immune to water, acids, and alkalis, it may be washed without harm, even with harsh detergents.

LACQUERS

Although these resins are insoluble in alcohol, gasoline, and ethers, they may be brought into solution with ketones, and for some types of Vinylite, esters are suitable solvents.

Lacquers can be prepared in this manner. These lacquers are much more resistant to the action of light, alkalis, and the common detergents or solvents found about the home than are either paints or nitrocellulose lacquers, and while they have not yet been marketed on a large commercial scale they are being used with gratifying results as refrigerator enamels and for architectural purposes. Their extreme resistance to alkalis has made it possible for the first time to formulate lacquers that are entirely satisfactory for the painting of Transite board, which is a composition of asbestos and cement. Vinylite lacquers have been successfully used for a number of years in the painting of swimming pools, one of the most drastic services to which a paint or varnish can be exposed. These differ from ordinary lacquers in that they do not contain other gums or resins, the lacquer is a straight solution of Vinylite resin, of the type best suited for the use proposed, to which small amounts of plasticizer have been added.

As a side light it is interesting to note that ordinary nitrocellulose solvents are, in many cases, without effect upon Vinylite and in those instances where they do have solvent power, the concentration of Vinylite resin in solutions that can be procured by their use is very low. It was therefore necessary to develop an entirely new group of solvents and work out methods for their production before such lacquers could be commercialized. Most of these solvents are high-

boiling ketones, several of which will soon be commercially available.

VERSATILITY OF VINYLITE RESINS

Many unique features of the application of Vinylite resins were developed and difficulties overcome in a commercial research project conducted in cooperation with the Pierce Foundation. The objective of the project, originating with the Foundation, was the development of new methods and the application of modern materials to the construction of homes. The successful conclusion of the project opened a unique field for the application of these resins and resulted in the development of new methods of operation of special interest here. The original plan for the model home had been completed before the project came to us.

Two things that were particularly desired—a door and a sectional wall panel—were giving considerable trouble. The door was specified as a light weight, smooth-surfaced, fireproof panel, 0.50 in. \times 2.5 ft. \times 6.5 ft., that would not warp. Wood was ruled out and metal would be too heavy. A door of hard rubber was attempted, but a great many difficulties beset the work and it was not successful.

A cooperative effort was initiated in an attempt with the Pierce Foundation to solve the problem. The first step was to rebuild the door mold which was originally designed for



PLATE 4. OPPOSITE END OF LIVING ROOM SHOWING LARGE MOLDED WALL PANELS, TRANSLUCENT WINDOWS AND EXTRUDED CEILING MOLDING MADE OF VINYLITE RESIN

hard rubber. Vinylite molding compound was spread evenly in the bottom of the mold, a fireproofed paper pulp board was carefully placed in the mold so that it would have 0.5 in. clearance all around, and more of the molding compound was added until the mold was fully charged. The platens were brought up to temperature with steam, the mold closed, and cooling begun immediately. The first door was a success and no difficulty was experienced in the manufacture of approximately two dozen more of the above measurements, which doors were installed in the model house and have proved quite satisfactory.

The second problem had to do with a method of sectional wall construction, employing large panels (see Figure 1), 2.5 in. \times 2.5 ft. \times 8 ft. with a deep groove on each of the 8-ft. edges. These panels were fitted together and then held in place by steel rods that traversed the core of the panels at three points, as shown in Figure 1. The groove molded into each of the long edges of the panels was large enough to permit a nut or sleeve to be screwed on the end of each rod. The rods passing through the panels act as trusses, with compression being applied by the nuts at the final or end panels. Thirty such panels were produced in a simple mold that consisted of two large aluminum sheets and removable steel strips used as a retaining ring around the sides of the panel. The top sheet of aluminum corresponding to the force of the mold was attached to the upper platen of the press in such a way that it traveled 0.5 in. down into the ring when the press was closed, thus acting as the force of a mold.

In order to conserve molding compound and lighten the weight of the final panel, a porous core of sufficient crushing resistance to withstand 250 lb. per sq. in. was used. This was completely encased in molding compound with clearance of 0.5 inch all around. Because of the simple and inexpensive construction of the mold, the channeled edges of the panels presented a difficult problem that was finally overcome by the use of extruded strips, which were put in place at the time the mold was charged with the molding compound. Since the aluminum sheets were too thin for steam passages it was necessary to heat the mold by conduction from the

platens of the press. Steam pressure of 90 lb. per sq. in. was used until the mold and the compound were thoroughly heated, then the mold was closed, the cooling water turned on in the platens, and the mold opened when cool. The resulting panels showed practically no warpage over their entire length and a section (see Figure 1) cut through one indicated equal distribution of molded Vinylite 0.125 in. thick on each surface. Even under the crude conditions prevailing, only one out of the first twenty-five panels molded was unusable, and in this case the trouble was caused by the bulging of the steel strips along the 8-ft. length. Blocking prevented this in the future.

The success that attended the molding of these panels which it is believed, so far as size is concerned, have never been equaled before, encouraged the authors and their associates to carry out the idea of the Pierce Foundation on a somewhat extended scale. It was therefore decided to build a three-room apartment utilizing Vinylite wherever possible. The plan of the apartment is shown in Figure 2, while Plates 3, 4, and 5 present different views of the apartment.

The walls in all cases were built of the large panels—twenty-four in all—previously described. Three Vinylite doors, 6.5 ft. \times 2.5 ft. \times 0.5 in., were molded in the same general way. They have a light but rigid core and are encased in a layer of Vinylite 0.0625 in. thick. The cupboard doors in the living room and kitchen are of similar construction but much smaller—15 \times 28 \times 0.375 in.—and those in the kitchen are made of white Vinylite, tinted with a trace of blue to give the effect of porcelain enamel (see Plate 5).

The complete apartment is floored with Vinylite tile made by a technic similar to that used in producing asphalt tile. As a matter of fact, the tiles were produced in the Waukegan plant of the Johns-Manville Company in the same equipment used in making asphalt tile. The only change was the substitution of the resin for the asphalt as a binder, the composition consisting of 22.5 per cent Vinylite resin, 2.5 per cent plasticizer, and 75 per cent slate flour and pigment. It was blended in a Banbury mixer, sheeted on calender rolls, and cut into the proper size by automatic machinery. The fact

that the resin is colorless makes possible the production of pastel shades without using excessive amounts of the embrittling and expensive light-colored pigments. To indicate the range of colors (see Plates 3 and 4) the tiles in the living room are alternately green and yellow, with a dark green border, whereas those in the kitchen are black and grey with a black border, and in the bath room the color scheme is coral and blue with a black border. The tiles are 0.1875 in. thick and were laid in the same manner as asphalt tiles. One advantage of this type of tiling is already evident. Because of their light color they always present a clean appearance and are easy to keep clean. In addition, the legs of chairs, bookcases, etc., do not make an indentation in them.

The lighting arrangements are quite unique. No direct lights are in evidence and all of the illumination is transmitted through translucent sheets of Vinylite about 0.0625 in. thick, which have a light transmission efficiency of more than 90 per cent.

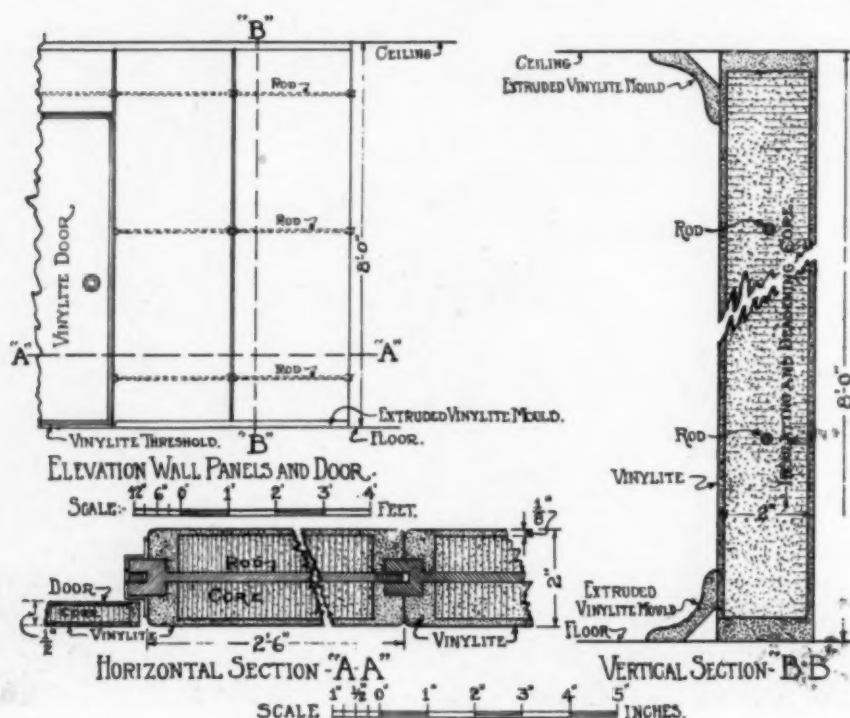


FIGURE 1. VINYLITE WALL PANEL DETAILS

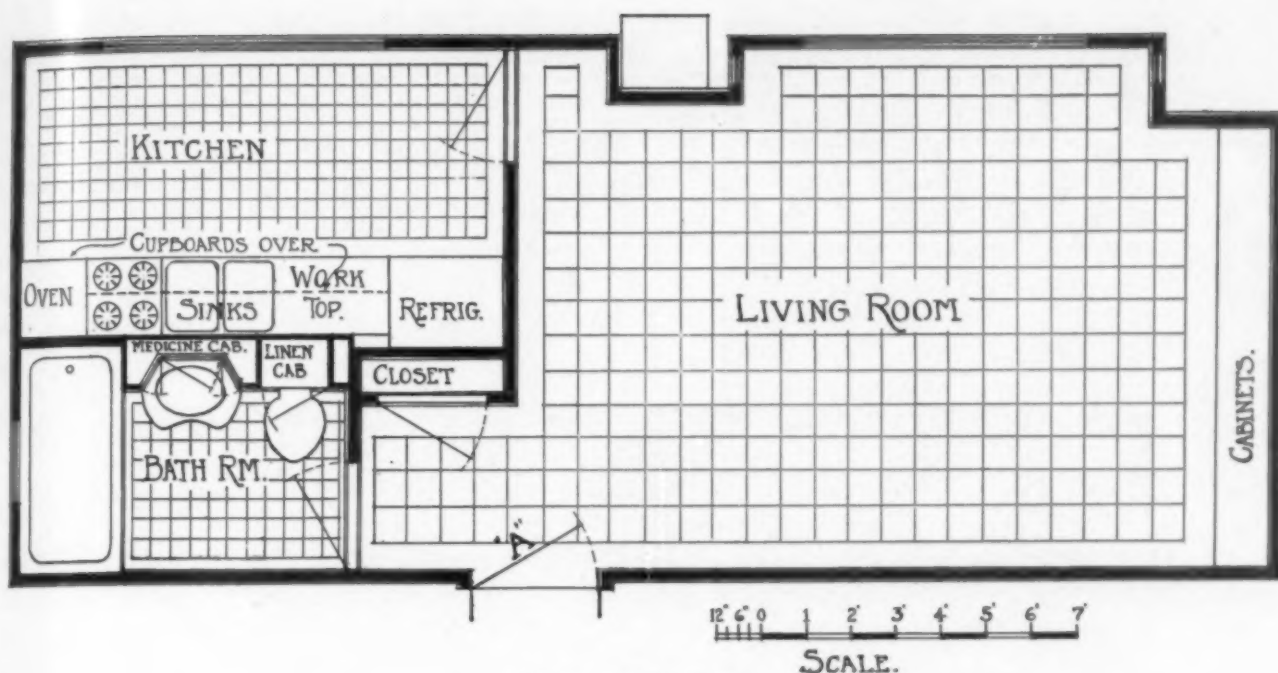


FIGURE 2. FLOOR PLAN

The molding around the ceiling, the baseboard, and even the door sills is all made of the extruded resin. Twenty or thirty foot standard lengths can easily be produced and, like lumber, sawed to any desired length on the job. The various towel racks and grab bars in the bathroom are sections of the same material of proper design and cross section. Vinylite was also used to mold the toilet seat, tooth brushes (see Plate 2), cosmetic and powder jars, the closures on the tooth paste and shaving cream tubes, as well as the cups, saucers, pitchers, tumblers, and trays in the kitchen cupboards. The same applies to all door knobs and electric switch plates.

For convenience and partially because the color scheme had not been decided upon when the wall panels were molded, all panels were molded in white resin and later were tinted the desired color with Vinylite lacquer. The refrigerator (does not show in photographs) and steel kitchen table (see Plates 3

and 5) were finished with a new type of Vinylite lacquer that resembles porcelain, while the steel outer door marked "A" in the plan was finished with a baked bright orange lacquer.

Even the windows are sheets of translucent Vinylite—they could have been transparent had the view warranted it. Almost everything in the entire apartment, with the exception of the plumbing fixtures, furniture, gas stove, and the bath tub, was made of Vinylite. This extends even to the ornaments, cigarette boxes, ash trays, and lamp shades.

While, as was stated initially, this apartment was built solely as a means of demonstrating the possibility of using this resin for architectural construction, with no attention at the moment to the economic problems involved, it is of interest that the more the project is studied the more feasible it becomes from this standpoint. One firm has already designed machinery for the production of Vinylite doors as a continuous production job. They not only will be better than the usual wooden door from the standpoint of appearance, warpage, and lightness, but they will be much cheaper when installed because they will be finished completely, even to the hinges, when they leave the factory. No labor will be necessary to hang them, except to fit the door knobs and lock into a place provided for them. It will not be necessary to plane or saw them to make them fit, as they will be molded to fit a certain specified opening and, of course, they will not have to be painted or var-

nished. The same observation applies to the floor tile, the wall panels, and the cupboard doors.

The materials from which this resin is derived are considered inexhaustible and the larger the scale on which operations are conducted the cheaper will both the resin and finished product become. On the basis of performance and probable cost it is reasonable to expect wide use of factory-fabricated Vinylite resin in architectural shapes, as well as of lacquers made from the unfilled resin.

TABLE I. CONSTANTS OF VINYLITE RESIN

	FILLED	UNFILLED
Molding pressures (lb./sq. in.)	250-2000	1200-1800
Molding temperatures (° C.)	120-150	115-130
Impact (Izod), notched (ft.-lb.)	0.10-0.70	0.10-0.45
Impact (Izod), unnotched (ft.-lb.)	0.80-1.50	2.0-4.0
Tensile strength (lb./sq. in.)	6000-7500	8000-10,000
Modulus of elasticity $\times 10^3$ (lb./sq. in.)	5.5-8.5	3.5-4.0
Modulus of rupture $\times 10^3$ (lb./sq. in.)	7.5-11.0	10.0-13.0
Brinell hardness number (550 lb.—3 min.)	15.0-25.0	10.0-15.0
Specific gravity	1.3-2.5	1.35
Softening point (° C.)	60-70	50-65
Water absorption at rm. temp.		
(% increase in wt. A. S. T. M.)		
24 hr.	0.20-0.70	0.05-0.15
48 hr.	0.30-1.10	0.10-0.20
168 hr.	0.70-1.80	0.15-0.25
Refractive index	1.52-1.53
Compression ratio ($\frac{\text{vol. loose powder}}{\text{vol. solid}}$)	1.5-3.5	2.0-2.2
Shrinkage (in./in.)	0.001
Burning rate	Does not support combustion
Volume resistivity (ohms/cu. cm.)	10^{11}	$>10^{11}$
Dielectric strength (volts/mil.) 25° C.		
(Instantaneous)	350-400	400-500
(Step)	300-350	325-345
Dielectric constant (1,000,000 cycles)	4	4
Dielectric constant (1000 cycles)	4-7	...
Power factor (1,000,000 cycles)	6.2%	1.75%
Power factor (1000 cycles)	2-15%	1.43%
Arc resistance to low energy arcs	Good	Good

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RECEIVED April 21, 1933.

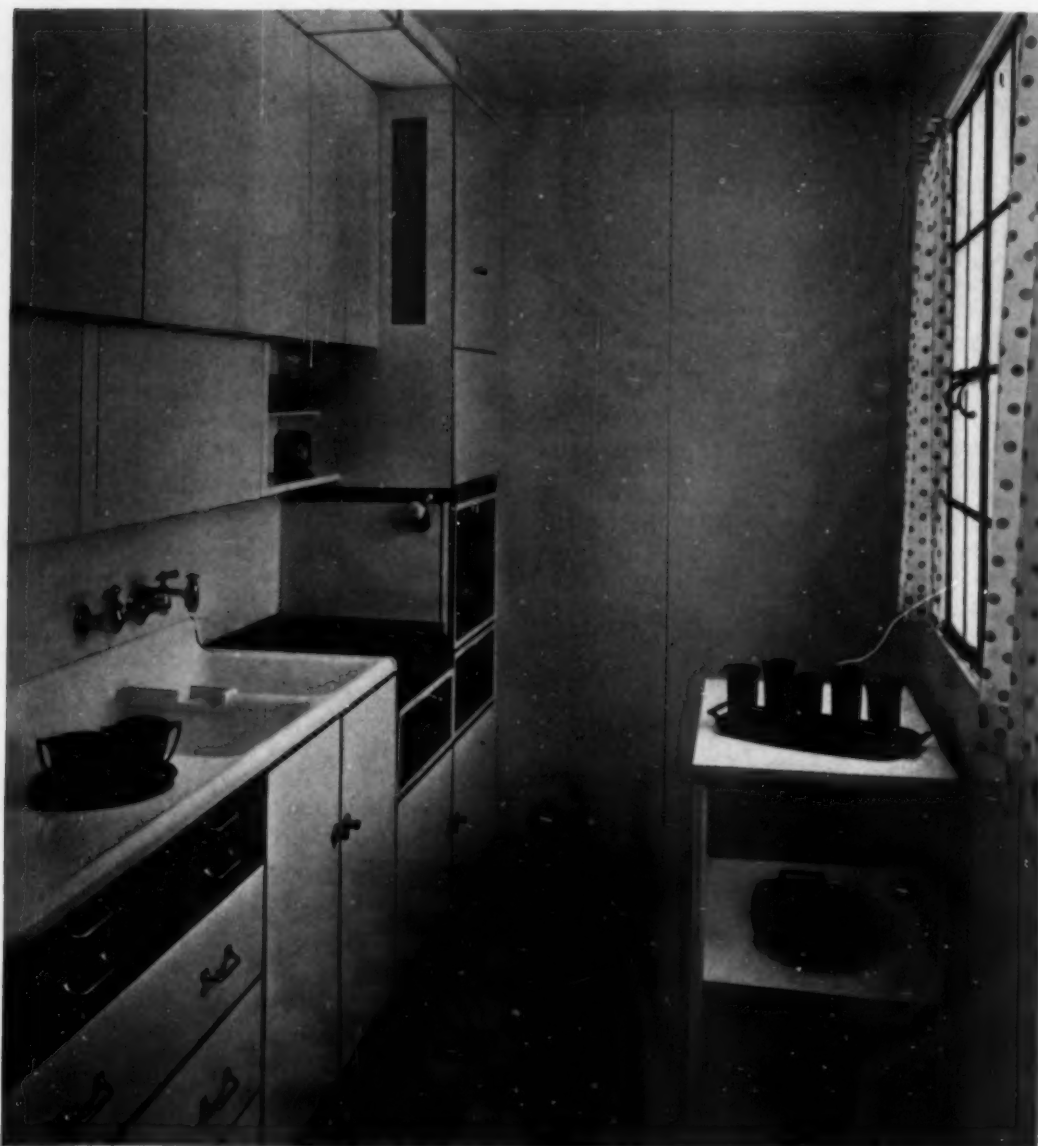
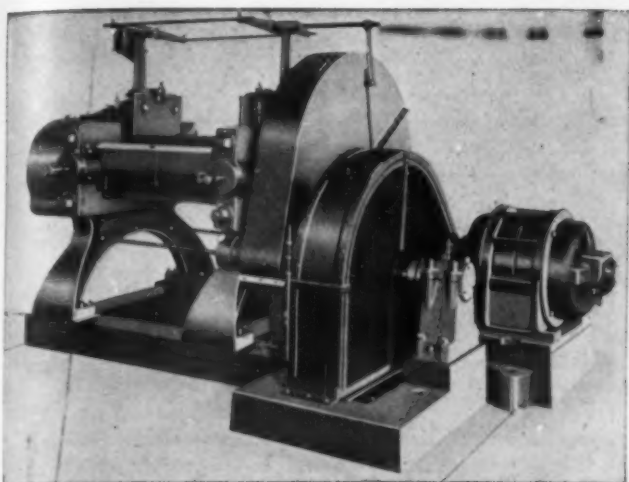


PLATE 5. KITCHEN SHOWING CUPBOARD DOORS MOLDED OF PORCELAIN COLORED VINYLITE RESIN WITH TRANSLUCENT LIGHT FIXTURES DIRECTLY OVERHEAD. WALL PANELS, FLOOR TILE, AND SMALLER OBJECTS OF VINYLITE RESIN

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RESIN DYES



Newer Developments in the Urea Resins

Summarized by
L. Smidth, Ph. D.

WITH the increase in importance of the urea resins many new and interesting methods of preparation, modification and application have very recently been brought to light. As an index of the increasing importance of the urea resins, there has been brought to the attention of the writer during the month of May alone over twenty-eight patents in addition to the published literature.

Work is continually being done to reduce the brittleness of the urea resins. This is particularly important in lacquers and must be done to prevent crazing. One method of preparing a lacquer is to mix a urea formaldehyde condensation product with nitrocellulose and castor oil which has been pretreated with an oxidizing gas at an elevated temperature. Another similar method, instead of using castor oil, uses animal oils treated in the same way such as cod oil, shark oil, whale oil, etc., together with an organic solvent for the ingredients including a substance such as a lower aliphatic alcohol and an acetic ester. A totally different method said to give non-crazing films is the use of water soluble salts of alginic acid, such as sodium alginate, with a water soluble urea formaldehyde condensation product.

Instead of softening the resin, a method has been disclosed whereby it is hardened. It is claimed that its wearing qualities improved without affecting the transparency of a film such as a surface layer of a phonograph record. The base may be of other synthetic resins or cellulose derivatives or mixtures of both such substances, and the method comprises incorporating a filler of diatomaceous earth in the form of a fine powder with the material to form a homogeneous mass. An example of a synthetic resin composition comprises 50 parts of urea or thiourea resin syrup, 25 parts of diethylene glycol, and 25 parts of diatomaceous earth.

Urea formaldehyde condensation products of different characteristics can be separated by distillation with steam. The method consists in condensing urea and formaldehyde in the presence of an organic OH containing solvent such as ethyl, butyl or isobutyl alcohol and the dispersion of the condensation products obtained is treated with steam. The product is dried, and is subjected to fractional extraction with an organic solvent such as benzene or

ethyl ether which is free from OH groups and is a low boiling member of its class, which serves to separate products of different characteristics.

A process for making foil out of urea resins has been developed in Germany. The solution of the condensation product is poured on a moving belt. The thin film formed is heated on the belt until the undersurface no longer sticks and can be pulled off.

The addition of small amounts of phenol or phenol formaldehyde condensation products to a urea formaldehyde condensation product does not cause it to darken appreciably on exposure to light. Based on this property a method has been worked out to produce cast products substantially stable to light. These products are obtained by condensing urea with a small amount of phenol and a considerable excess of formaldehyde. Excess of phenol and further excess of formaldehyde are then added. The mass is then made alkaline and the excess of water distilled off in vacuo at 50° C. Organic acid (e. g. lactic acid) is then added to render the mixture neutral, and the water is distilled off at 75° C. in vacuo. The product is then cast and hardened at 80° C.

A very unique method of hardening thermo-setting resins without the application of pressure has been patented in England. The resin which can be urea formaldehyde, with or without fillers, is poured or pressed into molds and hardened by passing electric currents through resistance wires disposed in, on, or closely surrounding it without application of pressure during the hardening process.

In the preparation of urea formaldehyde resins, two new processes disclose the use of low temperatures. In both cases urea and formaldehyde are condensed at room temperature until the reaction is over and the product is dried with or without fillers to form molding compositions. In one case a metallic oxide or carbonate is used to regulate the pH or hydrogen ion concentration (about pH 6.0), while in the other the pH is kept at a value of between five and six. In the latter process between 1.05 and 1.55 moles of formaldehyde are used to one mole of urea. A third process discloses the use of less than two moles of urea for one of formaldehyde and uses a pH of four to five during the condensation process and a pH of six to seven during the evaporation of the water.

Another new method for preparing molding compositions and lacquer constituents is to react urea or thiourea at atmospheric or raised pressure with an aldehyde, particularly formaldehyde, or an aldehyde polymer, in a hydroxylated organic solvent or solvents in the presence of a dehydrating agent, such as calcium chloride. Instead of urea or thiourea and formaldehyde, the corresponding methylol compounds or the products obtained from them by splitting off water may be used.



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Plastics in the News

Plastic Industry Considers Industry Control Bill — George Horgan Dies — New Lacquered Can for Beer — Catalin Sues Marblette — Commercial Solvents Again Wins — Oral Arguments in Lacquer Appeal Heard.

Industrial leaders have turned aside from the pressing problems incident to business conditions to analyze and digest the Industrial Control Bill. Out of all legislation passed at the present session designed to end depression no one bill will have more profound or lasting effect on business and the methods of conducting it than this. Enthusiastically applauded by business leaders when suggested abstractedly by the President at the U. S. Chamber of Commerce Dinner, the idea now reduced to specific terms in a bill fostered by Senator Wagner (N. Y.) and said to be largely drafted by the labor union lawyer, David L. Podell, contains several angles which are being strenuously opposed.

Chief objection lies in the dictatorship which the bill creates and which is the backbone of the bill. The *Financial Chronicle* in commenting on the bill states: "There are debatable methods and machinery set up to accomplish desired ends, the whole proposition being based upon the declaration that a national emergency exists."

Licensing Clause

The club to be used as an enforcement agency to drive reluctant manufacturers into organized groups is the licensing power by which, through the withholding of a license to conduct business, a recalcitrant or reluctant manufacturer may be driven into such a group in his particular line of business under penalty of being deprived of the right to continue his business upon an inter-state scope. The bill as passed by the House placed arbitrary powers in the hands of an industry dictator without leaving any method of appeal from any decision that might be made.

Another serious objection from the manufacturer's viewpoint is that the bill provides for collective bargaining on the part of labor on matters of wages and hours while producers are not accorded similar rights. Quite obviously objectors to this provision point out that matters of wage and hours of work are largely governed by local conditions and by conditions peculiar to each individual industry. It is felt in certain quarters that the bill has been written largely for labor and

*Senate is expected to pass measure June 9th. Conferees will then attempt to iron out differences between House and Senate measures.

with a minimum concern for the manufacturer and his problems.

Quite frankly the bill is designed as an earnest endeavor to raise the wage scale and to increase employment. Opponents of the measure point out, however, that if the major objectives are achieved that a higher wage scale combined with lower tariff barrier is more than likely to result in a flood of cheap foreign goods which can be sold in this country at extremely low prices. The final result will not be greater employment but rather even greater unemployment than exists at the present time.

The bill while before the House received scant attention from industry. Perhaps it was realized that it would be futile to

Features of Industry Bill

Industrial control bill in form said to be highly satisfactory to the President, was finally reported by the Senate Finance Committee. Licensing feature was restored, although in a limited form; sales tax was rejected, and a new taxation scheme substituted. Highlights of the bill as reported:

Licensing feature is to be operative only for one year and utilized only where there are unreasonable reductions in wages or prices.

Broad latitude given labor in organizing workers in the industries, uninfluenced by their employers.

Affords industry added protection against unfair competition from abroad by authority vested in President to place an embargo on imports if necessary in carrying out of purposes of the legislation.

Paves way for putting oil pipe lines under control of I. C. C.

Permits control of oil surpluses.

Tightens up existing revenue law in respect of deductions for stock and bond losses.

Imposes a 5% tax upon dividends, payable at source.

Assesses a one-tenth of 1% tax on the value of all corporations.

Increases 1c present Federal tax on gasoline to 1½c per gal.

Increases to 1% and extends for two years privilege of filing consolidated returns of corporations.

Rejects so-called "Buy American" provision of the House bill.

waste time and effort before that body. However as soon as the bill reached the Finance Committee of the Senate concerted attacks were centered on the dictatorship and licensing provisions. After a week's debate the Senate Finance Committee made several important amendments and the fate of the bill as we go to press rests with the Senate.*

Senator Reed (Pa.) has predicted that the bill will not be upheld by the courts and the final test of legality will come in the Supreme Court. It has been pointed out that the broad discretionary powers of the industry dictator are likely to stifle progress. Opponents point to the automobile industry as an example and say that if such a program had been practiced in the horse and carriage days that it would have been possible to have stopped one of America's leading industries. While this example may be somewhat far-fetched, it indicates that many fear that new products, new inventions, and new processes which would, by their very nature, upset existing conditions at least temporarily, might have hard sledding getting past a rather conservative industry dictator. This particular phase of the controversy has special significance for such industries as the chemical and allied groups such as lacquers, plastics, or any field where a number of new developments are likely to occur almost over-night.

The lacquer and plastics fields have taken preliminary steps, however, to set up an organization that will truly represent the plastic industry. The complete details of this movement are given on pages 132 and 133 of this issue.

Association Manager Dies

George Vincent Horgan, 55, general manager and secretary of N. P., O. and V. Association, and the A. P. and V. Mfrs. Association, died in Washington, May 25.

Mr. Horgan, born in Oswego, N. Y., formerly was secretary to John B. Stanfield, one of the leading trial lawyers of his day, and held various positions with the Erie and Lackawanna railroads, the N. Y. Public Service Commission and the Buffalo Chamber of Commerce. During the World War he was manager of the personnel division of the Chemical War Service, and in 1919 he became secretary to the Trade Association.

In 1926 he became general manager of the A. P. and V. Mfrs. Association. The annual award of the American Trade Association Executives was conferred upon him last year "for successfully operating a comprehensive, well co-ordinated and effective program in the interest both of the public and the industry."

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Coatings

Lacquer for Beer

American Can Co. is preparing to introduce shortly a special type tin container for the brewing industry, with a lacquer interior which will protect the brew. It is understood that special machinery will be installed in the American Can plants to produce these containers.

Experiments have been conducted by American Can for some time. For a time the management considered using a nickel lined container. The product has been shown to several breweries, and manufacturing operations on a commercial scale probably will be started shortly.

Lacquer Suit Heard

Oral arguments in the appeal of the nitrocellulose lacquer patent suit of du Pont, against Glidden was heard, June 7, before the Circuit Court of Appeals, on the fourth floor of the City Hall Post Office Bldg., in N. Y. City.

Green Bay Glass has been appointed northeastern Wisconsin distributors for Berry Brothers' line of paints, varnishes, lacquers and enamels, and has changed its name to Green Bay Glass and Paint Co.

H. W. Henderson, of John W. Masury & Sons, has been named sales manager of the western district with headquarters at Chicago, at 123 N. Sangamon st. Mr. Henderson succeeds B. A. Buckmaster, resigned. He has been with the Masury organization for eight years, being in charge of the company's sales promotion activities in eastern territory.

Berry Bros., Chicago Office, opened May 1 in new quarters at 300 W. Austin ave.

Egan & Hausman, Long Island City, N. Y., will continue and will not be affected by the death of the president, Herman Uehlinger.

Hercules' Birthday Booklet

Hercules Powder has issued a beautifully illustrated booklet of 40 pages commemorating the 20th anniversary of Hercules Powder in business. The title of the booklet is "The Growth of a Modern Hercules." The brochure is highly instructive and contains a wealth of information not only on the interesting history of the company, but on its various products. Copies are available by writing to The Hercules News Bureau, Hercules Powder Co., Wilmington, Del.

Molded

Cast Patents in Dispute

Catalin Corp. of America has purchased American rights under the Pollopat patents covering cast phenol-formaldehyde condensation products.

On May 10, suit was started under Patents Nos. 1,854,600 and 1,858,168 in U. S. District Court in Brooklyn against Marblette Corp. of Long Island City. It is alleged that these patents are infringed by the sale of opaque, translucent, transparent and clear materials as made by the latter corporation.

Harry Hudson Cutler, 73, electrical inventor and founder of the Cutler-Hammer Co., manufacturers of electric controlling devices, and well known in the plastics field, died at his home in Miami. He founded the company in 1893 in Chicago and was an official until 1917, when he sold his interest and retired.

Arthur J. Norton of General Plastics gave a talk on May 23 before the Niagara Falls chapter of the American Institute of Chemists on "Selling Research Programs to Boards of Directors."

Bakelite's New Product

Bakelite has developed new product called impact molding material, incorporating superior mechanical characteristics. It is a tough substance with several times the shock resistance of ordinary molding material, the kind that is used for bottle tops, switch plates, pencils and the like.

In many respects it is similar to the Bakelite laminated products, well known to the public in the form of radio panels, table tops, etc. It differs in the respect that it can be molded and therefore is adaptable to a wide range of shapes.

Ruberoid Co. declared the regular quarterly dividend of 25c., payable June 15 to stock of record June 1.

NEMA headquarters after June 17 will be located at 155 E. 44 st., N. Y. City.

Literature Service

Dr. Leonard Smidth, well-known in the plastics field, has opened consulting offices at 22 E. 40 st., N. Y. City. He is also offering a new service consisting of a world survey of both literature and patents. Details of the service may be had by writing directly to Dr. Smidth.

New Foreign Resin

New synthetic resin product, recently produced by research department of Metropolitan-Vickers Electrical, Manchester, (England) is being manufactured in sheet form. It is claimed to be weather-proof and rust-resisting and to be completely unaffected by the action of acids, with the sole exception of nitric. It has extremely practical uses—for the panelling of ships and buildings, for example, and for other important purposes.

Fusible and soluble resins, which are readily prepared in known methods by condensation of pure phenol and aldehydes, may be prepared, according to new British patent, from commercial phenol, which contains, as impurities, cresols and xylenols. Ordinarily resins produced from commercial phenol are only obtained in low yield or, if the reaction period is prolonged, viscosity of the reaction mass is increased and separation of the volatile products is almost impossible. If ammonia is used, however, good yields of readily fusible resins are obtained. Ten per cent. of 25 per cent. aqueous ammonia, relative to the phenol present, is the least amount necessary for successful production. Neces-

Paint, Varnish and Lacquer Sales: March

Sales of paint, varnish and lacquer products in March totaled \$4,364,702 in value, according to preliminary report of U. S. Bureau of Census from data supplied by 588 establishments. This compared with a revised total of \$12,345,600 in February and \$19,089,005 in March last year. A record of sales in March compared with revised figures for January and February and also a record of sales by month during 1932, follows:—

1933	Total sales reported by 588 establishments	Classified sales reported by 344 establishments—			Unclassified sales reported by 244 establishments
		Industrial sales	Paint and varnish	Lacquer	
January*	\$11,946,271	\$3,529,916	\$2,386,977	\$1,142,939	\$4,163,960
February*	12,345,600	3,417,387	2,439,732	977,655	4,767,355
March†	14,364,702	3,387,723	2,480,590	907,133	5,794,335
1932					
January	15,894,506				
February	16,270,822				
March	19,089,005				
April	22,612,193				
May	24,981,441				
June	19,637,358	4,685,399	3,617,719	1,067,680	8,734,330
July	14,430,122	3,793,245	2,900,707	892,538	6,058,813
August	16,032,441	3,851,028	3,057,096	793,932	6,918,659
September	16,805,712	3,980,564	3,113,303	867,261	7,216,748
October	15,592,377	3,996,500	3,036,323	960,177	6,610,011
November	13,260,328	3,599,319	2,639,362	959,957	5,196,766
December	10,127,780	3,222,770	2,186,706	1,036,064	3,406,715
Totals, year	\$204,734,085				

*Revised. †Preliminary.

Comparable statistics not available.

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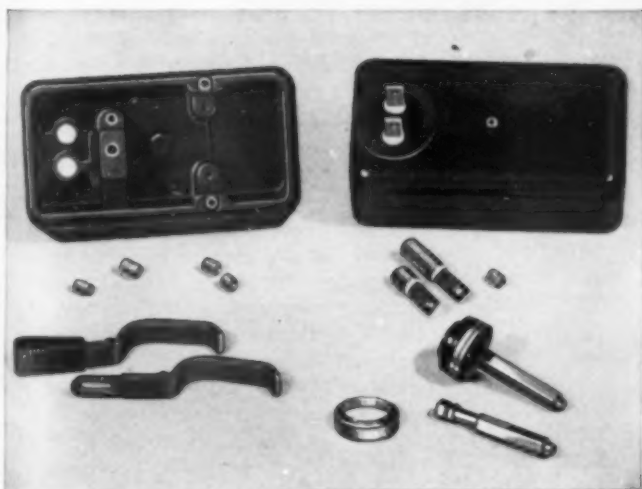
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sary details are given for the preparation of a reddish-brown resin having a melting-point of 70 degrees C.; it is pointed out that dyes may be added, as usual for ordinary resins.

June issue of the *Durez Molder* features the part plastics played in the construction, particularly the decorative effects, on the new *S. S. Washington*. According to the account over 36,000 lbs. of Durez slid down the ways with her at Camden, N. J.

LaChoy Food Products recently did a repackaging job and adopted a Durez molded cap.

Laminated

Loss for First Quarter

Continental-Diamond Fibre, including foreign subsidiaries, for quarter ended March 31, 1933, shows net loss of \$138,454 after depreciation, etc., comparing with net loss of \$162,374 in first quarter of previous year. Results from foreign subsidiaries are included in above figures at rates of exchange prevailing during the period.

Net current assets as of March 31, 1933, amounted to approximately \$2,870,000 of which \$1,026,000 represented cash and government bonds. This compares with net current assets of approximately \$3,236,000 and cash and marketable securities of \$1,183,000 on March 31, 1932.

Company states that since the beginning of the second quarter there has been a steady increase in orders received, the first two weeks of May showing substantial increase over same period of last year.

Income account for quarter ended March 31, 1933, compares as follows:

	1933	1932
Sales, less returns, etc.	\$632,860	\$749,297
Costs and expenses	666,667	802,678
Operating loss	\$33,807	\$53,381
Other income, net	3,069	5,471
Loss	\$30,738	\$47,910
Depreciation	107,716	114,464
Net loss	\$138,454	\$162,374

Solvents

Commercial Solvents Wins

Judge John P. Nields in Federal Court (Wilmington) May 23 held Union Solvents in contempt of court on charge of having violated an injunction of the court. Union Solvents was enjoined by the court last year from using the bacteriological process in making butyl alcohol and acetone, similar to the Wiezmann process as used by Commercial Solvents.

Joseph Wafer on June 15 will sever his connection with Industrial Chemical Sales, to become sales manager for Rossville Commercial Alcohol.

Anderson-Pritchard Oil has moved its research division's offices in Chicago to 3921 E. Ravenswood ave. Activities of the department have more than doubled in past year. Division was started in November, 1929.

Cellulose

American Institute for the Advancement of Science held an interesting round table May 26 on wood and wood products including the various cellulose fields.

Amerloid Mfr. Co., Brooklyn manufacturer of cellulose novelties, had a severe fire recently.

Production Statistics

Following table presents monthly statistics relating to pyroxylin-coated textiles based on data reported to the Bureau of the Census by 18 (a) identical establishments comprising most of the industry. Data given include products manufactured by spreading nitrocellulose or pyroxylin preparations, either by themselves or in combination with other materials, upon grey goods, such as sheetings, drills, ducks, sateens, moleskins, etc. Monthly capacity of the 18 establishments, amounting to 10,650,064 yards, in April, is based on a maximum quantity of 1.27 to 1.30 sateen, coated to a finished weight of 17½ ounces per linear yard, in a 24-hour working day, 26 days to a month.

	1931 April	1932 April
Light Goods:		
Shipments—		
Linear yards	1,510,665	1,131,294
Value	\$459,799	\$256,030
Unfilled orders (b)—		
Linear yards	987,736	689,731
Heavy Goods:		
Shipments—		
Linear yards	1,790,745	959,676
Value	\$1,073,395	\$455,342
Unfilled orders (b)—		
Linear yards	1,974,691	1,138,197
Pyroxylin Spread (c):		
Pounds	4,272,851	2,078,164

	1933 March	April
Light Goods:		
Shipments—		
Linear yards	1,195,658	1,352,893
Value	\$240,040	\$274,195
Unfilled orders (b)—		
Linear yards	792,122	996,850
Heavy Goods:		
Shipments—		
Linear yards	883,558	1,305,310
Value	\$383,515	\$569,701
Unfilled orders (b)—		
Linear yards	1,199,484	1,638,355
Pyroxylin Spread (c):		
Pounds	2,333,083	2,804,051

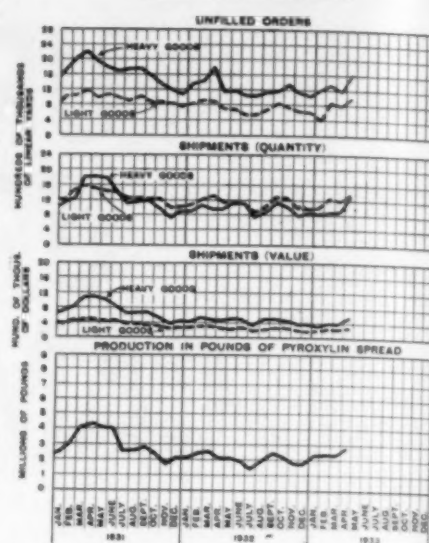
(a) Of the 18 establishments reporting for April, 1933, two establishments did not report prior to January, 1933.

(b) Orders on hand at the close of the current month (reported in yards only) exclusive of contracts with shipping dates unspecified.

(c) Based on one lb. of gun cotton to seven lbs. of solvent, making an 8-lb. jelly.

PYROXYLIN-COATED TEXTILES

APRIL, 1933
COMPARED WITH PRECEDING MONTHS



"A Century of Progress from 1833 to 1933 for Cellulose Nitrate" is the subject of an interesting article by Dr. W. C. Wilson of Pyroxylin Products, in May "Chemical Bulletin," of the Chicago Section of the A. C. S.

Following decision of U. S. Court of Customs and Patent Appeals made on May 22 is of interest to the plastics' field. No. 3629, U. S. vs. American Hecolite Denture Corp. Hecolithe base plates were assessed at 60c per lb. as compounds of pyroxylin made into finished or partly finished articles. Importer protested that they were properly dutiable at 40c per lb. as not, being finished or partly finished. Customs Court sustained protest, and their judgment is reversed.

U. S. Envelope Co. has developed Cellophane bags for use in refrigerator for preserving fresh foods and left overs. Moisture-proof and odor-proof they enable the housewife to keep butter and limburger cheese side by side in the refrigerator if she so desires. Bags come in various sizes, gored at the sides.

They are useful for keeping crackers and cookies from becoming soggy and for keeping bread and cake from drying out. Bags can be used several times.

Plastic Literature

Science Museum Library of South Kensington, (London), has made a complete collection of all plastic literature in the past few years. Bibliography of plastics of about 150 pages has just been issued, together with abstracts of all original material published with the exception of paints and varnishes. This includes list of patents and patent reviews. PLASTICS AND MOLDED PRODUCTS, the name of PLASTIC PRODUCTS previous to March 1, 1933, is responsible for the greatest number of leading articles abstracted.

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Plastic Patents

Abrasives

Abrasive composition comprising abrasive grains, a gum aceroides resin and a hardening reagent. No. 1,909,784. E. E. Novotny to J. S. Stokes.

Cellulose

Phonograph record whose sound record track is 70% ethyl cellulose. No. 1,907,520. C. Dreyfus to Celanese Corporation of America.

Derivative from a cellulose ester and an aromatic compound, having low inflammability. No. 1,907,521. Camille Dreyfus.

Process for the preparation of organic esters of cellulose. No. 1,908,499. C. S. Webber and C. J. Staud to Eastman Kodak Co.

Method of purifying nitrated cellulose with superheated alcohol. No. 1,908,500. David R. Wiggam to Hercules Powder Co.

Process of manufacturing cellulose acetate by esterifying pre-treated cellulose. No. 1,908,523. Carl J. Malm to Eastman Kodak Co.

Production of low viscosity cellulose acetate by supernormal temperature reactions. No. 1,908,524. C. J. Malm & A. Anderson to Eastman Kodak Co.

Cellulose colloidion for wet plate process. No. 1,908,529. Alexander Murray to Eastman Kodak Co.

The conditioning of long films of cellulose derivatives, by regulated tension, pressure and temperature. No. 1,908,546. Shepard & McNally to Eastman Kodak Co.

Process for manufacturing crotonic esters of cellulose. No. 1,908,746. Gault & Angla, (France) to Soc. des Usines Chimique.

Process for producing cellulose fibre material. No. 1,909,193. Fernando S. Vivas to Safety Products Inc., N. Y.

Changing the solubility of cellulose acetate by dissolving in a phenolic solution. No. 1,909,483. A. F. Bibaud (France) to E. I. duPont de N. Co.

Pressure method for decorating pliable celluloid articles. No. 1,909,514. M. M. Assael, (France).

Process for the manufacture of soluble cellulose esters, of higher organic acids. No. 1,909,798. B. M. R. Angla (France) to Soc. des Usines Chimique R/P.

The control of reactions between cellulose and liquid reagent, by highly volatile substance. No. 1,910,176. Muller & Schenck (Germany) to C. F. Boehringer.

Composition of unhydrated, stable, white cellulose fibres and a hydrophylic colloid. No. 1,910,416. G. A. Richter, to Brown Co., Berlin, N. H.

Method and apparatus for sheet of film of regenerated cellulose. No. 1,910,519. C. E. Coleman to duPont Cellophane Co.

Cellulose acetate preparation by acetylating cellulose in acetic anhydride, interrupted distillation. No. 1,911,068. Dreyfus & Schneider to Celanese Corp.

Treatment of cellulosic material and the production of cellulose ester products therefrom. No. 1,911,069. H. Dreyfus (England).

Coagulated and plasticized product of cellulose derivative, effected by polyhydric alcohol. No. 1,910,440. Leon Lilienfeld (Austria).

Coatings

Coating composition from cellulose ether, with a plastitizer, a resin, a volatile solvent. No. 1,909,935. Camille Dreyfus.

Cellulose coatings from artificial masses with process for production and gelatinizing. No. 1,909,991. Weihe, Jordan & Kollek, to I. G. F.

Lacquer containing shellac ester, cellulose ester and solvent. No. 1,910,100. W. H. Gardner, N. Y.

Process for dispersing pigments in cellulose ester solutions, and their products. No. 1,911,104. E. H. Bucy to Brevolite Lacquer Company.

Laminated

Glass plate with cellulose ester plastic carrying synthetic resin cement in binder. No. 1,908,004. J. C. Zola to Duplate Corp.

Groove-treatment of laminated glass for holding sheets of interposed plastic. No. 1,908,142. Gregg, et al to B. L. Gregg, Conn.

Corrosive liquid bath for removing periphery of plastic sheet between glass of laminated plate. No. 1,910,072. F. B. Trace to Duplate Corp.

Phenol and formaldehyde impregnation carrying uniform graphite, in fabric resistance unit. No. 1,910,391. Howard & Haroldson, to Contdfibre.

Machine for processing laminated glass. No. 1,910,748. George W. Burk.

Phenol

Purification of phenolic mixtures when impurity of low distillation temperature vaporizes. No. 1,909,546. V. Molinari (Italy) to Bakelite Corp.

Formulae and process for low-temperature phenol-formaldehyde resins. No. 1,909,786. Oscar Pantke to Catalin Corp.

Miscellaneous

Ornamental design for bottle cap. Design—89,874. B. F. Conner, to Colt's Pat. Fire Arms M'fg. Co.

Organic solvent and plasticizer. No. 1,909,092. H. A. Bruson to American Cyanimid Co.

Use of live flame and radiant surface nearby, as process for producing carbon black. No. 1,909,163. Roy H. Brownlee.

Electric reactions in vacuo, from methane and oxygen, to create formaldehyde. No. 1,909,215. Paul Nashan, (Germany; assigned.)

Fountain pen of cellulosic plastic with coating of electro-litically deposited metal. No. 1,909,795. Anderson and Ling to Celluloid Corp.

Molding powder reaction of rosin, formaldehyde and lime, with filler, cement and petroleum oil. No. 1,910,318. W. H. Boorne (England).

Molded cap type container closure with resilient liner. No. 1,910,913. B. F. Conner to Colt's Patent Fire A. Mfg. Co.

Phenolic aldehyde condensation product incorporated in pitch compound to a hard solid. No. 1,911,131. Langenberg et al to U. S. Pipe & Foundry Co.

Resins

Production of synthetic resin of phenol-formaldehyde type, from low temperature tar. No. 1,907,497. S. Caplan to Combustion Util. Corp.

Process for toluene sulphonamide aldehyde resins. No. 1,907,554. Moss & White to Celanese Corp.

In making the same synthetic resins, the step of heating the elements in presence of urea. No. 1,908,159. Moss & White to Celanese Corp.

Moldable resinous material, from condensing ammonium thiocyanate with formaldehyde. No. 1,910,338. A. M. Howald to Toledo Syn. Products Corp.

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And Now, in Closing:—

We are impressed, not to say staggered, by the news from the American Telephone & Telegraph Company that the United States has almost twice as many telephones as all Europe. New York City is eighth in "density" of phones—having 24.7 per cent. of its population on the wires as against the leaders' (San Francisco) 39.1—but still has enough telephones to equip all of London, and Berlin, and Paris and Liverpool! Perhaps all this over-equipment is the reason for the lack of interest in colored hand-sets.

When the A. T. & T. gives statistics, it gives them! When they last counted, this country had 56 per cent. of the world's phones, and any subscriber could get nine-tenths of the world from his own instrument. What we really want to know, though is: First, how many pay their bills within ten days from the date of this notice? Second, who made that call to Philadelphia? Third, how many wrong numbers could a subscriber get?

Our old line subscribers will recall the articles we had by Benn C. Budd. Well, Mr. Budd continues to write—this time for our contemporary "British Plastics & Molded Products Trader" with an article entitled—"Marketing your own Moulded Articles." Why? Benn leads the marketing division of W. P. Griffith & Sons, Ltd.

The American Beer Association will hold an exposition at Cleveland during the week of July 1st. For the first time in years, therefore, Independence Day will be personosified. Will you cross a few with us, Mr. Tennyson?

Robert W. Boise in "Pigments for Plastics" in this number presents a good, clear brief for dry lake colors. Moreover, his conclusions are based on experience. What say, you dyestuff manufacturers?

Don't be scared off by all the formulae in "Tests for Cellulose." This valuable data should be in every plastics' research department—that is, if you want to save time and money on your cellulose developments.

No foreign competition in the plastic field? Right here in New York one of the largest concerns in the country is purchasing thousands of dollars worth of molded, cast and machined material from Germany. It isn't price, and the heads of the business are anti-Nazi. So what and why? It seems no domestic producers want business, for they never call on them!

"ICH DIEN"

If you have read this month's editorial you know why we are glad to accept the invitation of the Organization Committee of the Lacquer Industry to serve as their mouth-piece. They soon found that they needed an organ of publicity which could wholeheartedly support the cause of lacquers even when the interests clashed with those of paint or varnish. They turned naturally to Plastic Products and although our experience as independent industrial publishers makes us hesitant of any official organ, nevertheless in this crisis, our duty is certainly to further in every way the prompt organization of an association of all plastic products interests. We have been able already to bring the lacquer and the molders groups into closer cooperation and we stand ready to further in every way in our power any fabricators of plastic materials, for while the Industries Control Bill has been checked by the Senate Finance Committee still it will become law in some form which will make it imperative for the plastics industries to organize or to have a Government Dictator thrust upon them.

W.H.

Wish we could get every purchasing agent in the country to read Ed. Bachner's article "Molds." It answers that question on the so-called high cost of molds by showing how and why a mold is built to give production service, not trouble. So don't overlook it, you P. A.'s who are subscribers, and pass it on to your friends.

This man Bachner, by the way, is one of a large family of brothers. They have made molds since they were old enough to walk, and yet they are still improving their technique. They have made them for everything from pins to bedsteads. And you can take us literally!

One good friend and "constant reader" used to joke (!) about the fact that PLASTICS

was just the right size to cover the bottom of a bird-cage. So we're fooling him by sending, collect, one oval-bottom cage, one ditto mirror, and one pound of buckshot. And if that doesn't bury the bird, we'll take him off the complimentary list!

The Fourth (asked, with 3½ bid) Estate is all agog over the millions of molded Skippy bowls. So say we all; this is truly a chemical age, especially for the youngest generation. Think of the countless children, the world over, who are this moment dipping their phenolic-handled spoons into their urea dishes to consume untold quantities of fufural (au natural) covered with casein in the raw.

The June Durez Molder calls "the news scoop of the month" the article on the Visualette Demonstrator which ran in the May *Product Engineering*. Right on the month, G. P., but wrong on the year. It was 1931—two years ago. And you're wrong on the magazine. It was this humble journal, especially written for us by engineer C. H. Whitlock of Norton Laboratories!

(Aside to the Editor of the above house-organ: Thanks for the kind words, but can't you mention our thousands of subscribers and be real statistical?)

From a town called—of all things—Devil's Lake, we received an inquiry for molded peace pipes. They will not be used at Geneva, but by Lo, the poor Indian. The fellow who has the idea might make some money by supplying the entire world (at cost, or better, of course).

Another friend recently drew a cheque, like any other plutocrat. It was returned, marked "uncollected funds". Adding in the protest fee, he tried again. This time it was "bank closed." He made explanations, added another fee and sat back to await developments. He got them: "account overdrawn because of recent assessment against you." In disgust, he has paid off in three cent stamps and is holding his breath for fear the old two-cent postage returns before they are used.

Midget radios are firmly entrenched, and many have asked "what next"? The answer, and it's a tip-off, is—midget cameras! Hundreds of them, to retail through the chain stores, combining molded plastics and metal. Watch for them!